Ecological Sanitation

Exploring Options for a Better Future

WORKSHOP REPORT

October 2 - 6, 1999 Harare, Zimbabwe

This is an original report compiled from discussions and decisions at the Ecological Sanitation Workshop
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Acknowledgements

The Ecological Sanitation Workshop Team wishes to thank all individuals, organisations, donors and governments who made this workshop a reality. We especially thank the Communities of Ethel, Guruve, Hatcliffe Holding Camp and Nyagande, and the Latham Family for allowing so many of us to visit their ecological sanitation projects and witness first hand their exciting new developments in the field. We also thank and praise our Field Team Leaders Mr. Cleophas Musara, Mr. Ephraim Chimbunde and Mr. Edward Guzha for their brilliant organisation, informative background information and patience.

In particular we wish to acknowledge assistance for the people and funding necessary to organise, manage, facilitate and make this a successful workshop. For this we thank the World Health Organisation, the United Nations Children's Fund, Mvuramanzi Trust, the Institute of Water & Sanitation Development, RELMA and the Ministries of Health & Child Welfare and of Local Government, Zimbabwe.

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The Workshop Facilitation Team

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Preface

We have a problem with sanitation: it is estimated that fully half of the world's 6 billion inhabitants do not have access to it and many do not practice good hygiene behaviours. We have a problem with uncontained, unsafe and unrecycled human faeces which are "shared" from person to person through personal contact, water, food or the environment. Faeces contaminated with harmful living organisms end up stunting and killing children, making people ill, over-burdening women and girls, causing loss of income, damaging the environment and holding back national development.

Ecological sanitation is an emerging option with great promise for solving Africa's sanitation problems. It has logical linkages to agriculture, forestry, income generation, waste management, the environment and many other sectors beyond the "traditional" health and hygiene aspects used to "sell" sanitation. Combined with social and cultural sensitivity to user needs; with participatory approaches for communities to identify problems, analyse them and take action; and supported by local and regional networks to strengthen information exchange and resource mobilisation, ecological sanitation may very well revolutionise this field.

We take pleasure in sharing these proceedings of the first Pan-African meeting on this subject. We hope it will stimulate your interest and involvement in ecological sanitation. For those already working in this area, we hope that the issues raised by the participants from 19 countries help guide you in holistic planning and implementation of practical programming and research.

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Executive Summary

1. Human safety is of foremost importance in ecological sanitation technologies and approaches.

It could not be over emphasised that whatever ecological sanitation technology or process is used that it must minimise risk of disease. Therefore although there exist a wealth of studies on pathogen destruction, for ethical and advocacy reasons each country ought to re-examine the evidence and/or pursue original applied research. This should be done in the context of their own cultural, physical and climatic situation to satisfy users, guardians of public health and government of the safety of ecological sanitation.

2. Ecological sanitation has great potential for synergy in linking different sectors for common goals.

Ecological sanitation could help expand developmental efforts for the people of Africa by connecting sanitation, health, water, gender, hygiene, agriculture, forestry, horticulture, food security, nutrition, income generation and environment programming. Therefore we advocate involving as wide a variety of sectoral partners in advocacy, research, cost sharing and programming.

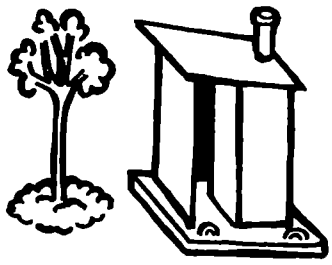
3. People's acceptance of ecological sanitation takes precedence over technologies and methods.

Although technology is also critical to acceptability, people's feelings, and attitudes, cultural and gender sensitivities, current practices and knowledge should be in the forefront of programming. Therefore participatory approaches (such as Participatory Hygiene and Sanitation for Transformation) ought to be used to implement ecological sanitation.

These issues resulted from field trips, group work, presentations and deliberations of 97 participants from Angola, Cote d'Ivoire, Ethiopia, Gabon, Ghana, Kenya, Malawi, Mozambique, Rwanda, South Africa, Swaziland, Sudan, Sweden, Tanzania, Togo, Uganda, the United States of America, Zambia and Zimbabwe.

Participants ranged from a few more knowledgeable people with field experience, to several new pioneers beginning their own pilots, to the majority who had never seen or heard of ecological sanitation before

Special thanks and congratulations are due to Zimbabwe for its courage in inviting so many outsiders to scrutinise their projects In turn thanks go to the participants for their constructive criticism and exchange of experience.



4. A variety of innovative ecological sanitation technologies are already in use in Africa, but there is room for more adaptation.

We have introduced ECOSANs, arborloos, fossa alternas, double-vaulted chambers, "thunder box" collection buckets, urine diverters (collection and soakaways), modified Blair/VIPs, tippy taps, skyloos, jerican urinals, sanplats and others, all of which enjoy varying success among users under certain circumstances. There is room for more and improved technologies particularly to address women's specific needs (for privacy, seat type, personal hygiene, separation of urine / menses) and children's specific needs (for size and height of seat/pedestal/urinal, closeness to home, available light). And although the issue of cost has been addressed admirably in most cases, more ideas for cost-saving and sharing are still welcome. We urge continued adaptation, experimentation and innovation along with documentation of uptake, acceptability and use under specified conditions, with details on relative costs and technical sustainability and replicability.

5. There is great variation in technologies, purposes and "successes" among countries piloting ecological sanitation in Africa.

Zimbabwe is using a variety of technologies and approaches to address different economic and socio-cultural needs in rural, peri-urban and school settings, but has only recently begun pilot projects. Ethiopia is recognised as having the longest history of research and development for re-use of resources in urban and rural agriculture, but have yet to implement wide-scale community projects. South Africa is doing valuable work in technological adaptation and pathogen destruction but has also yet to go to scale. Kenya is addressing urgent peri-urban high-density sanitation problems but is at small-pilot stage. Therefore we encourage continued experimentation, innovation, and expansion of research, development and programming in order to replicate ecological sanitation on a wider basis.

6. People in Africa have not readily taken up improved sanitation and hygiene behaviours solely on the promise of improved health, but respond enthusiastically to the "bonuses" offered by some ecological sanitation systems.

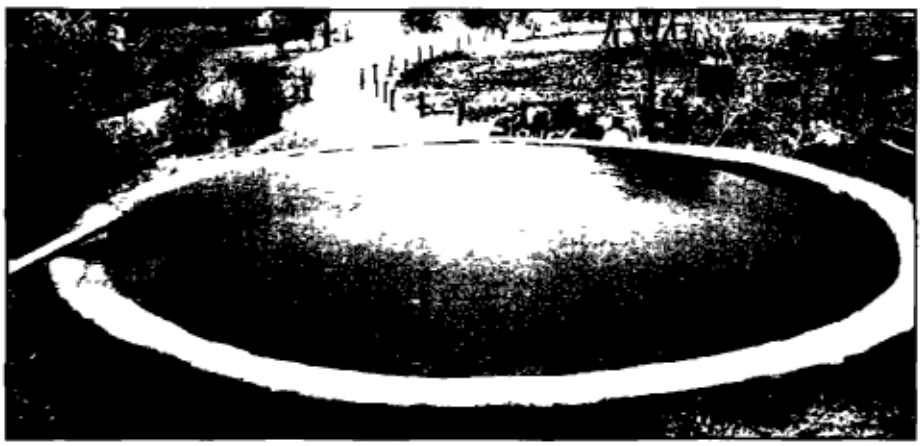
Individuals, communities and the commercial sector seem ready to "buy" ecological sanitation because it "rewards" them with a free source of fertiliser, increased crop/plant production, cash, or convenience in addition to solving health, sanitation, hygiene or waste problems. Therefore it may be appropriate to emphasise perceived benefits in advocacy and promotion while also providing health information from case studies and research results so that people can better make informed choices.

7. The nutritive value of human products is a pressing information and research issue.

Along with continued research on human safety we urgently need to know more about the nutritive values of urine and fecal matter. Therefore we urge research and exchange of experience on this issue. We need to know about its suitability in Africa for different plants, under different soil and climactic conditions and how they compare to commercially produced fertilisers. We need to know how best to apply urine to maximise fertiliser, microelement and micronutrient values and more about the soil conditioning benefits of composted faeces. We need to be able to fill knowledge gaps by either tapping existing resources or carrying out original research.

8. Water is necessary to any ecological sanitation system.

Whether its objectives are to improve health, hygiene or sanitation, to solve problems in human waste disposal, to supplement agriculture, forestry or horticulture or to generate income, ecological sanitation depends on a reliable supply of water to enable hygiene (hand washing, food preparation) and/or irrigation. Therefore linkages should be made to water supply when implementing ecological sanitation.



9. The definition of ecological sanitation is not "set in stone".

Although it was anticipated that the issue of a definition would create heated debate, human and technological issues were clearly of more importance. Participants seemed to understand intuitively what it meant and no one was held back by not having a strict definition. It was agreed in principle that "ecological sanitation" should have something to do with managing human excreta and/or urine at minimum risk to human and environmental health. It may or may not reuse or recycle human resources and it may or may not be connected to agricultural systems, so that technologies vary. Therefore it is recommended that the definition remain flexible to respond to different cultural, socio-economic, programming and funding needs.

Introduction

The purpose of this workshop was to bring together persons from across Africa to exchange ideas and learn from each other about tested, experimental and emerging technologies, social and scientific methodologies, processes, research and innovations in the field of ecological sanitation.

Although there have been workshops on ecological sanitation in Sweden, the United States, Latin America and perhaps elsewhere, as far as is known this is the first time that such a meeting was being held to focus on the Pan-African experience.

Background

It was well known that Ethiopia has had the longest history of experimentation and research in ecological sanitation on the Continent and for this reason it was the logical first choice of venue. However, it happened that three other workshops related to the water and sanitation sector were already scheduled for Zimbabwe at about the same time. Regional workshops for Participatory Hygiene & Sanitation for Transformation and the Africa 2000 Networking & Co-ordination for Water and Sanitation meetings were set to take place in Harare in late September/ early October 1999 whilst the International Training Network for Water & Waste Management was to follow in Kadoma. Therefore in the interest of cost-saving and sharing, to alleviate travel fatigue of participants who would be attending several or all events and to maximise and cross-fertilise each other with ideas for networking, linkages and the ways forward, Harare was selected as the place to gather.

A slight disadvantage in Zimbabwe was that none of the ecological sanitation projects or programmes (research, development or community intervention), were beyond the experimental stages. However, the advantage was that there were such a variety of pilots available and they were all run by open-minded and generous families, communities, schools, field workers and support staff who were willing to let outsiders examine their works-in-progress.

Rationale for the agenda

Realising that the very concept as well as the practical functioning of ecological sanitation would be something quite new for most of the participants, and recognising that "seeing is believing", the bulk of the time was spent in touring pilot projects. A brief overview of Ethiopia and Zimbabwe Country experiences was given after registration. Then three and a half days were devoted to visiting different places up country by bus. During the field trips, structured small group work was organised so that participants could exchange experiences and ask about technological, social, health and hygiene aspects of the projects and ecological sanitation in general. It also provided an opportunity for Zimbabwe's community project stakeholders to gather constructive feedback.

The final day was spent reviewing case studies, research proposals and additional country presentations with in-depth discussions about these and the field trips. At this stage the ecological sanitation playing field was considered to be a bit more level between experienced and non-experienced participants and everyone was able to contribute to emerging issues (as seen in the "Executive Summary") and in defining the way forward for ecological sanitation in Africa (see " Outcomes").

A novel part of the field trip was the request to have participants make a small voluntary donation to the development fund of each of the communities that were visited. This simple gesture was intended to encourage local mobilisation and in some small way recompense the communities for their time and hard work in organising the visits.

PHAST Regional Workshop

In addition to sharing experiences in participatory approaches and updating country level workplans, the main purpose of this workshop was to allow participants to review, amend and endorse the creation of a PAH&S/ PHAST Regional Support Network as proposed late last year. This Network is intended to bolster local and regional institutional capacity for sanitation and hygiene in Sub-Saharan Africa. A Participatory Task Force for Hygiene & Sanitation Transformation in Africa (PTF-A) was established to direct a PHAST Network (which was agreed to in principle). Many of the Network members were also participants of the Ecological Sanitation workshop, helping to establish links accelerate programming, collaborative research and co-ordination between the two fields.

Africa 2000: Networking & Co-ordination Workshop

The purpose of this workshop was to exchange African country-level experience in establishing effective mechanisms for intersectoral collaboration and co-ordination for environmental sanitation , hygiene and water supply. It's objectives included the establishment of more effective networking and co-ordination, particularly through International Training Networks (ITNs) and Resource Centres in support of National and sub-national efforts to accelerate and sustain programme development and research in the sector. To support this, gaps were identified, a Regional Plan of Action was developed and participants assisted in the review of Africa 2000 WHO/Afro Guidelines for Co-ordination and Networking. Particular emphasis was placed on strengthening partnerships with UN agencies (such as WHO, UNICEF, UNDP, World Bank and others) and Regional institutions (such as SADC, OAU, ECA and others) and the Africa Working Group of the Collaborative Council. Again, many participants had attended the PHAST and ecological sanitation workshops ensuring that this wider Network will facilitate Pan-African dialogue and decision-making on ecological sanitation.

Challenges in Sanitation

Extract from remarks given by The Honourable Minister of Health & Child Welfare, Zimbabwe to Officially Open the PHAST, Ecological Sanitation and Africa 2000 Networking & Co-ordination Workshops, September 29, 1999

"Countries throughout the globe face continued and escalating challenges in implementing, managing and sustaining hygiene and sanitation programmes. But the picture is growing ever more critical for we in the developing world. Population growth, declining economies, epidemics and natural and man-made disasters have put tremendous pressure on our scarce resources. Changes in socio-economic structures and human settlement patterns are having significant, detrimental impacts on our abilities to respond to, much less keep up with our people's needs.

Ten years ago, the United Nations General Assembly declared 1981 to 1990 as the "Decade for Water and Sanitation" in an effort to escalate programming for the underserved populations of the world. Ten years on, and at the threshold of the next Millennium, our problems are not only unresolved but have grown in number and scope. By last year, more than 3 billion of our fellow human beings still had no access to basic sanitation. And over 60 per cent of those billions are in Africa.

Coverage is only one aspect of the situation: it is estimated that over 60 per cent of sanitation facilities in existence are not operational at any given time. Poor hygiene practices continue to contribute to the death of over 3 million children a year. Water-washed and water-borne diseases allow malaria, diarrhoeas, scabies, eye infections and bilharzia to particularly plague our children and women. The need is therefore greater than ever to develop and act upon strategies, policies, research and programmes to deal with present and future challenges in hygiene and sanitation ...

... Ecological Sanitation, [goes] hand in hand with PHAST in improving approaches and technologies for hygiene and sanitation. Ecological sanitation is any process that protects human health, does not pollute, re-uses urine and/or faeces and reduces water waste. It is a promising solution for our Region in that it has the potential to help us solve critical problems in sanitation as well as food security and production, income generation, agriculture, forestry and environmental pollution.

Several examples of ecological sanitation technologies and approaches as used in Zimbabwe will be seen on field trips during the upcoming workshop. We trust that our visiting colleagues from South Africa, Ethiopia, Kenya and other countries where ecological sanitation has also begun, will share their experiences with us. These collective experiences, in addition to discussions about ecological sanitation as practised elsewhere, will hopefully inspire others to pilot this important initiative. It is our aim to have everyone help advance ecological sanitation through applied research on human safety and pathogen destruction, fertiliser values, social acceptance and other topics. It is also our aim to ensure that what you develop is culturally and socially acceptable, gender sensitive and complimentary to existing approaches ..."

Dr. Timothy Stamps
Honourable Minister of Health & Child Welfare
Harare, Zimbabwe

Field Trips in Zimbabwe: Day 1

Hatcliffe Holding Camp: A High Density Urban Area

Mr. Ephraim Chimunde, Mvuramanzi Trust Technical Leader provided background information on Hatcliffe. *"When people were moved here they were provided communal toilets by the government. These were problematic because they weren't maintained and most are now blocked up. Latrines seen on the tour were built by individual families — simple twin pit composting types without vents. These are appropriate for single ownership but as the project spreads it is anticipated that maintenance might not always be as good. Therefore the next stage will be to build composting latrines with vent pipes, particularly for schools."*

Highlights of the Field Trip	*Suggested Improvements*	*Lessons for the Region*	*Questions*
The project is highly subsidised	Community inputs need to be increased to ensure sustainability and replicability	Solutions can certainly be sorted out if funding is adequate	Can the people themselves replicate these latrines?
Complete structure costs approx. Z$4,000	Reduce costs by using materials which people can provide		Can people with informal incomes afford these types of latrines?
They are an ideal solution to the existing problem	Maybe there is a need for two slabs to be in place at once	It is possible to address sanitation crises in informal settlements in an effective way	Are the people themselves going to empty the latrine contents for re-use?
Pedestal seats may be too high to use by children	Put a lid to ensure that children use the toilet easily	Environmentally adaptable structures are better	How available are ashes? What are the alternative absorbents available?
The superstructures are very suitable for the environment			
The technology used seemed to be an acceptable option and standard		Individual family units are preferable to communal latrines by communities	Are the people happy to accept this technology? Were there any other options given to them?
There is a concern that the pits may fill up as the water table goes up	Increase the depth, width and length of the pit but maintain the slab size	The soil structure and profile are important factors in technology choices	

Group 1: Technological Issues

Mr Chimunde further explained to participants on the Hatclicliffe tour that

"The plan for the current latrines is to use one of the two pit for 5 to 6 months then move the slab over to the second pit The programme is now only into its first 1-1/2 months. Mvuramanzi Trust would not have been able to implement such a large scale project if the community itself had not done the implementation The people first formed their own Development Committee whose members came forward to guide participants "

Group 2: Community & Social Issues

After the tour, participants worked in small groups to make an analysis of what they had seen Because of a shortage of time they decided to debrief the next day but before leaving gave Hatcliffe Exchange & Community Development Project Z$800 via Mr John Odolon of Uganda who gave thanks to the community.

The next day, the Executive Director of Mvuramanzi Trust called attention to the fact that some participants had taken a rather aggressive attitude towards the community on the visit They were reminded that this was not good behaviour and did not accord with the rules of PHAST!

Highlights	*Social Observations*	*Problems*	*Questions*
Strong community participation, use of PRA tools (e.g. mapping). People can identify their own problems.	The society is cohesive and well structured.	Community said there is prevalence of diseases, which is why the community asked for help with a clinic	Why is there no permanency about the latrines? Only a meter deep which is suitable for emergency setting
Training included not only the technological side but also leadership skills.	Problems are complex and great; needs urgent action	There is still a problem with inadequate water supply	Are latrines affordable especially using treated wood and cement?
Project multi-sectoral: involves government, Mvuramanzi Trust, IPA, World Vision Intl and SCF	Need to add latrines for the schools and clinic.	Sanitation facilities are still inadequate	What about climatic considerations (in 6 months it will be the rainy season)?
There is a high demand for water provision as well as toilet facilities	Did not observe any malnourished children though people said they were there	Not sure of attitude to accept faecal matter as vegetable manure 1 user won't allow children near it, scared about using it without gloves.	Will it be possible to control a disease outbreak (such as cholera)?
There is a lot of innovation on the part of the community especially in ways to wash hands.			Potential danger of young children contacting diseases from latrines? People mentioned a lot of diarrhoeal diseases.

Highlights	*Observations*	*Lessons for Region*	*Questions*
People's use of toilet paper was remarkable· newspaper also used (which both go into the pit)	Common diseases: - upper respiratory diseases due to poor ventilation, use of polluting fuels in homes -Skin rashes due to washing clothes in polluted water from nearby stream -No mention of diarrhoeas -too early to assess health impact of ecosan	Technology (alternative ecological sanitation designs) is as hygienic as other pit latrine technologies.	Composting system seemed hazardous. -concerned about use on fields or trees after 6 months, what of ascaris eggs? -is aerobic digestion possible in shallow pits? -average of 6 users per pit/family? -safe to empty with shovel then put in garden?
Hygiene education v. effective/good- women/children wash hands after defecation using water (no soap or ashes) -impressed by women who said knew how to break route oral- faecal disease transmission	Ash (from households using fuel wood) and soil are used in latrines to reduce smell		People accept the use of human waste. -they say can even buy "it" from city council so it must be safe -people believe 6 months retention time OK for germ safety as told butwe have doubts (is it safe)?
People said that before they had to use communal toilets or bush and are happier with family latrines	Slabs are able to be made locally; pedestals are also able to be made but are expensive		Soakaways used for wastewater: how healthy is runoff in gardens?
Women say they clean their toilets every morning	Some toilets locked to prevent other than family from using		Can people use ash if they can't afford soap?
	Problem with pedestals: small children not able to use them as they can tip back into seat		

Group 3: Health & Hygiene Issues

David Proudfoot clarified the "permanency" issue by saying that Hatcliffe is a "holding camp" and the question of permanency has been going on for seven years
The government doesn't want to let families have ownership because as far as they are concerned this is purely temporary
As an NGO working with government Mvuramanzi has had to make sure nothing had the air of permanency to avoid confrontation and keep everything above board. This is a parameter, which has guided the choice of technology. Rural people in rural areas have more flexibility.

Group 4: Reuse of Human Resources

Before they built their own ecological sanitation toilets, the people of Hatcliffe used to put their "stuff" in plastic bags at night and throw them down the communal latrines in the day. This was because there were no lights and the latrines were far from the houses. This made communal latrines both dangerous (particularly for women and children) and inconvenient.

The plastic bags thrown in the latrines would stuff up the pumps used to empty them, so that now no company would empty the communal latrine pits!

Highlights	*Suggested improvements*	*Lessons for the Region*	*Questions*
Water reuse is encouraged as from hand washing and to water flowers and plants	Weakness in re-use of hand pumps runoff. concerned about stagnant water. Could this be reused?	Use of ash/soil effective in controlling flies and smell.	Is the project sustainable in view of such subsidised funding?
School latrine full after 2 months; a series approach was used of 4 pits, rotating from 1 through 4 then returning to the first.	Confusion over arborloo concept· planting trees does not seem appropriate for settlement conditions	The technology is appropriate for limited, small spaces	Are there future plans to shift cost sharing ratio? It looked like a lot more input from the project, not from community.
The community appear to consent to try to use technology use the human faecal matter process (though one drunk man said "we only use animal waste"	Urine has not yet been separated.	Ideal for institutions such as schools -potential for projects (to plant trees using human excreta/urine)	Were the people involved in the re-use design? Do they want it over other designs or were they given any choices?
Effectiveness of ashes to control flies observed even if not our mandate.		Institutions such as schools can be used to reach a vulnerable target group.	Technology does not clarify: any intent to reuse products from mixed pedestals?

Mr. Ephraim Chimunde answered the question of whether the Hatcliffe Development Committee could take over maintenance of the communal latrines. He explained that maintenance is controlled by the Ministry of Local Government, not the community. Ministry was digging new pits and rebuilding the old ones, but there are too many latrines for them to maintain. With families owning their own latrines, there is better maintenance, privacy, safety and convenience.

Field Trips in Zimbabwe: Day 2

Musimboti: EcoEd Trust Experimental Farm

Mr. Jim Latham explained that *"Ecological sanitation is being rediscovered, particularly by countries in the North and West. It has been practised for most of human history, particularly in the Orient in China, Korea and Japan. In the West the recycling of human and animal excreta and household garbage back into the soil was a common practice on European farms up to and including the Second World War. After the War chemical fertilisers pioneered earlier in the century were vigorously marketed. N,P,K (Nitrogen, Phosphates and Potassium) were cheap, easy to transport and apply chemical ingredients for fertiliser meant to increase productivity - the so-called Green revolution of the 1940's and '50s. However, proponents of N,P,K fail to take into account that soils are more than chemicals - healthy plant growth depends on a rich mix of micro-organic activity and important associations between soil and plant."*

Mr. Latham was raised on a farm where "natural farming" was practised. This included composting human faeces and urine together with other animal manure, household scraps, vegetable "wastes", grass, etc. producing a steady output of compost covering some two acres to fertilise the farm. Today fourth generation family members live at Musimboti and eat food grown on soils composted in this same way.

As was to be seen on the field trip, various types of ecological sanitation privies are in daily use by family members and staff at Musimboti. These range from pedestal seats and urine separators over enclosed chambers, through "thunder boxes" (commodes with straw lined buckets) to double-chamber "Blair compost latrines", to Arborloo shallow pit latrines, first named and used at Musimboti. The common factor linking them all is the return of the product to the soil. A strong emphasis is placed on addition of lime, wood ash, topsoil, leaf mould or already composted material to the chambers as both a covering and as a medium to encourage micro-organic activity leading to composting. Composting is seen as an intermediary stage.

Homex is a word coined by Jim Latham and Peter Morgan to describe human "wastes" including faeces, urine, kitchen garbage and animal manure. It is short for "homo sapiens excreta" or "ex" / "out of" the home". Compost is made using the Indore method where animal and vegetable products are mixed in layers to produce the considerable heat necessary for aerobic decomposition. EcoEd believes this may destroy most pathogens as in pasteurisation.

The EcoEd (Ecological Education) Resource Centre is located on Musimboti, Latham Family property. Mr. Jim Latham, Resident Director of EcoEd is an applied Social Scientist or "Human Systems Ecologist".

EcoEd Trust focuses on research and development in Community-Based Management of Natural Resources, project identification and situation analyses, using participant observation, PRA, RRA and adaptive management techniques EcoEd is particularly concerned with the development of appropriate technologies that reinforce organic, natural farming and "closed loop" ecologically sustainable system approaches

EcoEd defines ecological sanitation as a method of safely returning so-called human "wastes" to the soil and to the cycle of life: birth - growth - death - decay - (re)birth.

NOTE: because of a shortage of time, participants did not do group work for Musimboti or Ethel. A donation from participants was given to Ethel Community through the EcoEd Trust

Musimboti was once an area of rocky land with little or no topsoil. It has been transformed into a healthy vegetable garden and fruit orchard. This was planned using "permaculture" and is now a sustainable, fertile and productive plot contributing to the self-provisioning needs of the family and staff.

For ecological sanitation to be effective as part of the nutrition/life cycle (or food loop) it is necessary for the concept, technology and management to be culturally acceptable to the people who use it. It should conform to their worldview or cosmic-vision and be part of a sustainable overall system. This is more important than the size or shape or type of latrine.

Ethel: Abandoned Mining Community

Mr. Latham explained that Ethel is an old "high-density" mineworkers village, abandoned by a large company when the near by asbestos mine closed. It is on a badly degraded farm which was strip-mined for chrome and is now owned privately by Feoch Trust. Feoch have purchased the land to develop as a low-density residential area and nature conservancy. It has passed the management of Ethel to Eco-Ed but provides assistance with repairs and maintenance of housing.

Ethel is now inhabited by small-scale miners who work for co-operatives and a growing number of self-employed semi-skilled workers (builders, carpenters and craftsmen) all of whom are poor. Prior to the intervention of Feoch and EcoEd Trusts, the people Ethel had no land for vegetable gardens, no water and no sanitation. Their priority need was for sanitation but with limited funding, Eco-Ed could only afford to help people build arborloos, which need only cement for slabs. Subsequent help from Save the Children (UK) enabled every household in Ethel to have its own privy. The toilets are used for defecation as well as all disposing of household residues and "rubbish", helping to make Ethel spotlessly clean. Fruit trees have been planted in the holes already filled by daily use.

By arrangement with Feoch Trust an area close to a nearby perennial spring has been set-aside for vegetable gardens and a start has been made towards self-provisioning. Water from a borehole is now pumped to a reservoir above the village from where it gravitates to stand pipes serving the houses.

Field Trips in Zimbabwe: Day 3

Nyagande: Rural Communal Lands

Highlights/ observations	*Suggested improvements*	*Lessons for the Region*	*Questions*
Beneficiaries seem convinced, positive	Hygiene aspect needs more emphasis	A lot of discussion in community regarding safety of pathogen destruction Would use manure for fruits but not vegetables	Cultural issues: is there acceptance? Purpose of ash in the pit and how it should be handled?
Vegetables and crops grown using rain water only	Need to address concern about handling of urine	Piloting relatively new: results need documenting, dissemination regionally	Handling of faecal matter a question
Cow dung is not used			Siting of latrine? Who decides and why?

Group 1: Health & Hygiene Issues

Nyagande is a community on rural communal land populated by subsistence farmers. Mvuramanzi Trust has helped families build single vaulted, urine diverting composting pit latrines. They have helped schools to build communal vaulted, urine diverting composting pit latrines.

Highlights/ observations	*Suggested improvements*	*Lessons for the Region*	*Questions*
Deliberate use of Blair latrine problematic because of lack of light, but people trust design so it is used	Lack of extension support for agriculture: link between latrine/ garden needed for school latrine/garden	Families want proof it's safe to eat produce. Want tests from Ministry of Agriculture Positive sign to want proof (but still eating produce).	Put amount of fertiliser in perspective: amount relatively small. Enough to grow all required food?
	Farmer unsure which plants benefit more from urine: link to agricultural support.		Would smell of garden deter farmers from using human fertilizer?
	Families hesitant about children handling faecal matter: need more involvement.		Could having large urinal in one room reduce cost of having urinal in each chamber?

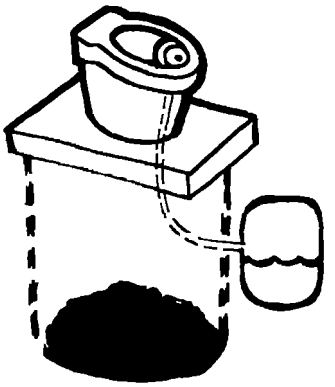
Group 2: Agricultural Use of Human Resources

Group 3: Farmer's Ideas & Concerns

Highlights / Observations	*Suggested Improvements*	*Lessons for the Region*	*Questions*
Demonstration of urine as fertiliser is good.	Recommendation: beans and peas do not need urine.	Sustainability of ecosan yet needs to be demonstrated and confirmed	Can urine be used alone?
Concept will not be successful for subsistence agriculture, but good opportunity for enterprising farmer to create demand for "homex".	Chemical fertiliser contra urine time factor; except on beans it was good. Compost and urine should be combined.	Water is essential for the technology.	Is urine enough for big scale? Proportion of urine to water?
Availability of water was good	Smell of urine x chemical fertiliser	Pathogen destruction safety information [needed]	Time and condition of composting secure?
Good pilot compost was observed.	Education is an important factor. Menstruation should be cleaned		

Highlights	*Observations / Suggested Improvements*	*Lessons for the Region*	*Questions*
Male (mono) urinal provided	Urine collecting jerican beneath the ground & protecting slab seem too high (owners not complaining)	Field experience is good	Has there been increase in ecosan toilet users?
Use of locally available (appropriate) material e.g. hessian material	Trials (research): manure alone; reduce NHz loss	Use of fish for food	
	Can it be used communally?		
Pan or toilet seat has urine diverting component	Jerican for unne collection should be above ground for easy removal		
Faecal (solid) matter not used in the field yet, being used for pathogen die off study; examination of pathogens 98% die off completed.	Urinal for men not suitable for kids		
Women do not use during menses	Water point should be diverted for home use		

Group 4: Urine Separation Technology



Field Trips in Zimbabwe: Day 4

Guruve: A School Environment

Group 1: Teacher's Issues

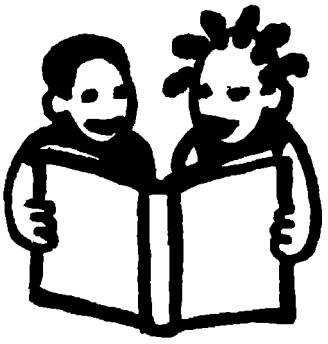
Guruve is a Primary school with mixed (boys and girls) day pupils.

Mvuramanzi Trust has helped the school to build communal vaulted, urine diverting composting pit latrines

Highlights	*Suggested improvements*	*Lessons for the Region*	*Questions*
Teachers are knowledgeable and clear regarding issues	Use measuring cups for ashes as handling might produce risks.	Parents get information from teachers: negative interest	Use of female toilets in particular: urine channel, might this clog?
Research programme /experiment developed with kids. Positive attitudes.	Methods of measuring concentrations, applications of urine needed.	General District education: interested	
	Distance to final output collection point seems far?		
Teachers were consulted during planning and implementation phase.	Need review in order to reduce urine handling At the moment teachers need to provide close supervision.	Gradual introduction / organically	
There is a health coordinator in the school.		District Education Officer personally interested contributing to positive outcomes.	
Application of technology positive, produced some results, maize.		Integrating components in school curriculum:-flexible hour in day used for environmental health work: cleaning regular and supervised (1 class weekly)	

Highlights and Observations	*Suggested Improvements*	*Lessons for the Region*	*Observations and questions*
Use of school as an entry point was a good idea Hoping parents can learn from project and adopt in homestead	Monitor ratios of [commercial] fertilizer and urine so that comparisons are on same level.	Technology should accommodate all ages as well as gender	Time allowed for fecal decomposition?
Willingness to try new technology is a very good gesture.	Grade 1 boys: check whether urinals user friendly (too high?)		Vegetable garden: on use of fertilizer how was it applied? Difficult to compare [to commercial fertilizer].
Willingness to start experimental garden impressive· needs encouragement.	Concern that smell from boys rooms would discourage use (smell may be caused by poor ventilation)		Is time sufficient between use and collection of fertilizer?
	Link to agriculture needed. Support, knowledge of human fertilizer use is low		Type of mechanism used: difficult to retrieve urine?

Group 2: Educational Issues



Group 3: Observations of a family compound

Household had both Blair and urine separation toilets.
Urine separation in advanced housing. Urine can easily be collected for a tap. This system looks as if it requires high maintenance.
The compound was for a wealthy family. We observed many ecological innovations such as a system that makes use of the methane in cow dung for cooking gas. Why did the wealthy families receive sanitation facilities? We concluded the "chief" would set an example and legitimize the urine separation process by using it first.

Group 4: Health & Hygiene Issues Specific to Children

Highlights and observations	*Suggested improvements*	*Lessons for the Region*
Students didn't mind eating vegetables fertilized w/urine but parents did (want urine on trees only)	Redesign seat: raise front to solve girls' problem of soiling	If properly designed you can reap the fruits as expected i e. urine and faeces
Separation of urine / faeces different for male / female	Ensure washing of hands: place tippy-taps at toilet entrances	New technologies have advantages/ disadvantages due to fears. Once addressed it is OK
Urine tank (1,200L) collects from all toilets for 2 grades· full in 3 weeks	Avoid too much urine handling: collect only once in container to garden. Fill bottles from there.	Before you can sell your ideas you need to carry out a few experiments.
Facility for washing hands is located centrally the drainage of the water is wasted.	The boys are mostly used for collecting urine Both boys and girls should collect urine, not just boys	New toilets don't smell as they apply ash
Students didn't mind handling urine	The children use gloves for handling urine.	Experimentation indicates urine is good for some plants

Community Expressions

Some entertainment activities on the day the participants visited Nyagande included speeches by officials and music, physical education, traditional dance and poetry by the students. We reprint some of the charming expressions made to the visitors here.

Mvuramanzi Trust The Great
Honourable Mvuramanzi Trust
Thank you for your profound support
You got us out of a serious latrine problem

We are proud of your support
Muzika now is a centre of attraction
Hundreds of people now flock to Muzika
Only to see the wonderful structures
You have erected

On fertilise purchase we have become cost effective
We now harness our own fertiliser

Who would ever know that our bodies had the precious resource?
Off hats to you Mvuramanzi Trust
Your work is much appreciated
We look forward to your continued support

Thank you
Written by Tariro Mapirah

School Children

They come in uniform
In little groups
Rushing
through the gate
Like birds
chased from a tree

Sun rays
penetrate the wind

In front of desks
stands a teacher
Ready to teach
A quarter moon
smiles on his face

Children in classrooms
see through the win-
dow
At short brown grass
And the playing birds

At last
lunch hour comes
And they all
rush home
With empty curved
stomachs

Written by
Memory Chakaodza

From the Regional Director of Health

It is indeed a great honour to be invited to this important occasion at Muzika Primary School and to share with you the joy of observing this new technology: ecological sanitation research project.

We are particularly glad that this school has been chosen to be part of this research.

This technology is coming to light now although we have been practising it unknowingly. It is great to note that human beings have very free fertilisers which have been put to waste. That is why research has come up with this type of urine diversion toilet, the key of which is that faecal matter and urine should not mix. Faecal matter should dry on its own thereby killing disease-causing organisms known as pathogens. The separated urine becomes a ready fertiliser because it contains the three properties: nitrogen, ammonia and potassium.

If the Eco-San project is accepted in Zimbabwe then we will be able to solve the problem of fertilizer in the next millennium. Muzika Primary and indeed Ministry of Education is proud to carry the ecological sanitation flag supported by the Mvuramanzi staff

People may doubt the ecological sanitation idea, vowing that it might be dangerous to handle faecal matter or urine. However, how many times have we as parents and individuals handled faecal matter or urine whilst attending sick adults, children, babies and even during our own relief without meeting any danger? We are still alive. The remedy ladies and gentlemen lies in washing your hands thoroughly after doing any operation.

I want to proudly say and declare that Muzika Primary has done it.

It has shown commitment to this research and has our full support as a Ministry. We implore the school to be an example to other schools and communities not only in Guruve District but in the whole region, Zimbabwe, and the world.

I would like to thank the Mvuramanzi Staff and Ministry of Health and Child Welfare for inviting us onto the ecological sanitation research train.

From the Ministry of Education, Sport & Culture

We welcome this great privilege to address an august gathering such as this which comprises delegates from not only Zimbabwe and its neighbours, but also from other countries of greater Africa and abroad. Obviously the journeys that have been traveled by road, by sea, and air to come to this place have cost a lot of money. We therefore attach great importance to this meeting with such diverse participation.

We heartily welcome you all.

We understand that the purpose of this meeting is to promote "Ecological Sanitation" which in Shona would mean ***"Maitiro achisikira"***. What we have experienced about this project is that what we used to term "human waste" (urine, faeces, ashes, papers or leaves) can be recycled to produce useful but cheap manure. *Saka tingati "Ecological Sanitation muchero usina masvisvinwa" (Usina chiraswa).*

We Nyagande people must count ourselves lucky to be chosen to be the centre of the research.

We would like to say thank you to UNICEF for funding the Project. We would like to say thank you to Mvuramanzi Trust through Mr. Guzha for leading the implementation of the project. We thank Ms Valley and her District team for their rare magnetism to attract national and international experts on environmental health.

Our school is benefited with a block of ecological Blair toilets for use in the school garden, thanks to the research project. Commercial fertilizers are becoming unaffordable. If we need to continue with bumper harvests, ecological sanitation is the answer. Mr. Kapondoro, Mrs. F & G. Chigwamba have already answered the call. Its now your turn Village Heads Chidyiramumba, Hodzi, Mun'ando and Mupini. As Education Officer, I would like to thank the parents, teachers and pupils who shall use the ecological sanitation toilets as expected. It is our hope that such facilities shall be extended to more schools and communities in our district. Thank you parents for buying children uniforms. Thank you for building enough classrooms for the children to guarantee more learning time.

To our guests we say: Go ye in peace. God bless you. Leave more ideas to our local Environmental health experts. Send more ideas when you get home. Continue to share ideas to improve living in the future. We Nyagande UMP people shall mark this day in memory of you. We shall never forget you. We declare the school's Ecological Sanitation toilet officially open.

Mr. V. Kujinga DSO/EO UMP North for the Regional Director Mashonaland East Region

The Way Forward in Ecological Sanitation in Africa

Group 1: Technology and Pathogen Destruction

Participants divided into four small working groups and discussed specific areas in ecological sanitation They presented recommendations on the way forward for ecological sanitation across the continent of Africa as seen in this chapter.

Issues, questions and concerns from these presentations, along with informal dialogue and notes from the field trips were synthesised in the Executive Summary (see page 1).

Technology

- Ecological sanitation is a closed system used to collect and decompose human resources.
- The cycle is only complete when the products end up in agriculture.
- Urine separation maximises the agricultural potential of resources.
- It is a sustainable technology particularly in dealing with the human resources.
- We should explore possible investments from the private sector to use the end products.
- Communities/users must be sensitised to see the "waste" as an asset (human resource).
- The aim should be to make the technology affordable and demand responsive.
- Users must be encouraged to use the technology freely.
- The technology and concept of urine separation should be presented in a user-friendly way.
- Regarding the use of ash, where it is not available we should identify other substitutes.

Pathogen destruction

- We must use an ethical approach to health and safety.
- Not enough known about pathogen destruction. Although more informa tion may be out there, it is not widely available.
- Not enough is known yet to call ecological sanitation to the attention of policy makers (for example a type of latrine in Ghana was popular but local government deemed it unsafe and intervened to phase it out).
- Further refinement should be made of waste handling technologies to ensure safety (develop and fund testing for urine and faeces so defini tive statements can be issued).

Group 2: Social & Behavioural, Health & Hygiene Aspects

Social Behaviour

- Whatever technology is used social and behavioural considerations must be an integral part.
- Community participation/involvement needs time and resources (with the use of such approaches as PHAST). Ownership must be there in order to benefit the people with detailed plans and activities initiated by communities. Resources should be allocated to training.
- Projects/programmes should promote Community Based Management (and have links to society, with we outsiders coming in to provide supports).
- Ecological sanitation should be widened as far as applications. Don't limit it to agriculture, but linked it to energy (e.g. biogas), prevention of environmental degradation and other areas). Technologies should be optional accordingly.
- Advocacy is needed at all levels on an ongoing basis, as it is a rela tively new concept.
- Implementation should be demand driven.
- Indicators for behavioural change need to be developed. These will differ from country to country so must be developed for each for M&E.
- Increase people's capacity at all levels (human resource development).

Health & Hygiene

- Develop effective sustainable Health & Hygiene programmes. Impor tant when dealing with "potentially dangerous" material.
- Continue monitoring health status of existing pilot project populations.
- Continue to compliment what is currently being promoted for sustainability (i.e. in the health and hygiene service).
- Health and hygiene should precede hardware implementation.
- Develop clear and simple messages for beneficiaries. There should be a framework and strategy for implementation and messages about the advantages and disadvantages.
- Use peer educators such as the early adopters of the methodology.
- Need to address the fear of handling processed faeces.

Regarding the Process

- Needs assessment including PRAs and social studies
- Meanings and values (bottom up approach)
- Social studies that define the meanings and approaches (taking tech nologies and gender into consideration with documentation paramount)
- Existing activities take further research and document the findings and take appropriate action
- Project cycle: planning model

Regarding Policy

- Introduce Ecological Sanitation as an option with alternatives.
- Incorporate PHAST into ecological sanitation as a prerequisite.

Group 3: Application for Agriculture / Forestry; Resource Mobilisation

Principle involve all, be gender responsive, maintain constant Information, Education, Communication - involve the community in the process, don't keep it as secret research, maintain wide stakeholder involvement; be sensitive to vulnerable groups and their needs; encourage ecological sanitation through the development of nurseries and seedling distribution, and undertake participatory monitoring & evaluation.

Ways forward for agriculture & forestry

Before application

- Form a multi-sectoral team (donors, ministries other stakeholders)
- Perform National level laboratory pre-testing (this must be established on a national level within each country)
- Establish sectoral linkages

During the pilot stage

- Demonstrate at community level (this may be the hardest part!)
- Use a sampling of the population (representative of entire country)
- Measure community response to develop a strategy to sell it
- Develop guidelines and a curriculum in a technically sensitive way (Ethiopia has a set of technical guidelines if anyone is interested in seeing an example)
- Develop promotional tools & strategies
- Document test results (e.g. yields, costs, community responses, etc.)

When scaling up

- Advocate to the general public, small and large farmers (such as flower growers) and policy makers. Large farmers might help establish the ideas as something not just for the poor.
- Use government institutions for implementation
- Embank on household level campaigns
- Promote commercial use of human waste ("commodifying crap"!)

Managing human resources

- Community: committees must be established
- Project staff must support communities
- Financial sources should come from the community with the voluntary sector
- Materials/logistics: promotional materials, resource centres and techni cal guidelines are needed
- Communication: we all need to exchange information with others on best practices at community, national and regional levels.

Group 4: Regional Networking / Communication

Networking

- It's important to network: start in your own country, then within Africa, then go global.
- We need new research and more and shared results. Don't be afraid of poaching. And ask questions: "asking questions doesn't make you stupid". Nothing is irrelevant.
- Networking, how do we do it? Use e-Mail, but also keep in ordinary mail contact with others. Use workshops, seminars and courses, newsletters (many ITNs have their own newsletter — please con tribute with information about ecological sanitation), any forum that deals with WES, just as PHAST did. Create awareness to a larger group.
- Do we need a secretariat? Create one in your own country network and in your own workshops. Many of us didn't know about ecologi cal sanitation before. Share what happens and where. Create rela tionships with each other not just UNICEF but with NGOs and other partners at country level first. Get ecological sanitation on planned agendas going on now. Link ecological sanitation with PHAST and to urban issues.
- Institutional leadership at country and regional level: can it happen globally?

Policy

We agree what we mean by policy - ecology, economy, etc. A lot needs to be done in research, advocacy and awareness to push the ecological sanitation agenda. We are not convinced we have the data to base policy on: more than half of us were ignorant about it when we came here. So it's too early to start with policy statements. We need to be better educated on ecological sanitation first.

Questions / Additional Comments by participants after the presentations

- Networking is important locally for research.
- The technology we have seen has mostly been subsidised. Demand driven movements should be created as they are more sustainable.
- It is important to carry out KAPs and document processes from the beginning to generate scientific information.
- There is need to expand programming, and need for a planning cycle or model at country level.
- Identify user groups. Tailor-make technology to respond to their needs.
- Health messages are important especially on the reuse aspect.
- Let's not forget hand washing facilities.
- If people are prepared to use human resources on an orchard, don't force them to eat vegetables grown with human products until they feel it is safe.
- It's important to remember that in some cases people don't have sanita tion or latrines of any kind. Don't get bogged down on the reuse of resources if waste management is the objective.
- Health status monitoring is for both the health project and the people.
- Find ways to co-operate with research institutions globally and locally: attract students from your own and other countries to help you study pathogen destruction and other research.
- Often there is not enough time to get community participation because of donor pressure, so you get people who are half convinced. We must try to budget for sufficient time for acceptance.
- We need to learn more about nutritive values in urine and composted faeces to know which crops are best suited for which technology and approach.
- As the technology is refined there will be more options. Start by build ing on existing programmes.
- Anyone who does piloting can help us all by documenting and network ing.
- Sanitation policy is not easy to change: we must be sure of the safety to health and the environment. If we can show income generation and safety, it will strengthen our argument.
- As a starting point for networking we had e-Mail correspondence but need to widen this.
- Do we need a secretariat or can we link to PHAST?
- Who is the focal person or institution in Africa? Do we have one for each country? Should we elect someone? They need to have e-mail and be willing to network with others.
- We need to address the issue of subsidies.
- If income generation works, it may take off on its own without subsi dies.
- A lot of respect for each other was shown at this meeting and I'm thankful we all got together. It gives those of us working in the field a lot of strength!

ANNEX I

Workshop Agenda

Saturday, 2 October

9:00 - 10:00am **Registration at Harare Holiday Inn**
by Mrs. Patience Mtakwa

10:20 - 10:30am **Introductions / Opening remarks**
by Mr. William Rukasha

10:45 - 11:00am **Review of Agenda / Regional Experience**
by Mr. Brendan Doyle
Introduction to Team Leaders / Field Teams
by Mr. Cleophas Musara

11:05 - 11:25am **Overview: Ecological Sanitation in Zimbabwe**
by Peter Morgan

11:25 - 12:30am **Overview: Ecological Sanitation in Ethiopia**
by Ms Almas Terrefe and Mr. Gunder Edstrom

12:30 - 1:00pm **LUNCH**

1:00 - 1:30pm **Bus Trip to Hatcliffe, Harare**
Bus Monitor Mr. Ephriam Chimbunde

1:30 - 4:00pm **Tour of Hatcliffe High-Density Holding Camp**
(ecological sanitation toilet technologies: fossa alterna, arborloo; health & hygiene education; peri-urban management committee)
by Mr. Ephriam Chimbunde, the Hatcliffe Development Committee and staff of Mvuramanzi Trust
Group work in Teams

4:00 - 4:30pm **Donation to Hatcliffe Development Committee**
by Mr. Odolon John

4:30 - 5:00pm **Return to Harare**

Sunday, 3 October

9:10 - 10:00am **Presentations of Hatcliffe Group Work**
by Mr.Cleophas Musara

10:00 - 12:00am **Bus Trip to Mutorashanga**
Bus Monitor Mr. Cleophas Musara

12:00 - 12:30pm **PICNIC LUNCH**

12:30 - 1:30pm **Team Tour of Musimboti: EcoEd Trust Farm**
(ecological sanitation toilet technologies; composting human products)
by Mr. Jim Latham and Mvuramanzi Trust staff

2:30 - 4:30pm **Bus Trip to Ethel** (soil enhancement in environmen tally degraded area)
by Mr. Jim Latham and Mvuramanzi Trust staff
Donation to Ethel Development Fund

4:30 - 6:30pm **Return to Harare** (no group work)

ANNEX I

Monday, 4 October

8:30 - 11:00am **Bus trip to Nyagande**
Bus Monitor Mr. Cleophas Musara

11:00 - 1:00pm **Team Tour of Nyagande** (rural toilet technologies, composting, human resource use in agriculture)
by Mr. Edward with Ministry of Health & Mvuramanzi Trust staff

1:00 - 1:30pm **PICNIC LUNCH**

1:30 - 2:30pm **Group work in Teams**
by Mr. Edward Guzha

2:30 - 3:30pm **Group Presentations and Donation to Nyagande Development Fund**
by Ms Salome Mwendar

3:30 - 6:00pm **Return to Harare**

Tuesday, 5 October

8:30 - 10:30am **Travel to Guruve**
Bus Monitor Mr. Edward Guzha

10:30 - 12:00pm **Tour of Guruve** (school toilet technologies, hygiene education and school garden)
by Mr. Cleophas Musara, Guruve School & Ministry of Health staff

12:00 - 1:00pm **PICNIC LUNCH**

1:00 - 2:00pm **Group work in Teams**
by Mr. Edward Guzha

2:30 - 3:00pm **Group Presentations/Guruve School Donation**
by Mr. Edward Guzha

4:00 - 6:00pm **Return to Harare**

ANNEX I

Wednesday, 6 October

8:45 - 9:00am **Introduction to Full Country Presentations**
(agenda and expectations)
by Mr. Brendan Doyle

9:00 -10:00am **Presentation: Ethiopia ECOSAN**
by Ms Almas Terrefe and Mr. Gunder Edstrom

10:00 - 9:40am **Discussion**

9:40 - 10:20am **Presentation: South Africa,**
The Campbell Experience
by Mr. Richard Holden

10:20 - 10:30am **Discussion**

10:30 - 11:00am **BREAK**

11:00 -11:20am **Presentation: Kenya,**
Urban Technologies in Kisumu
by Mr. Obiero Ong'ang'a & Mr. Kinya Munyirwa

11:20 - 11:40am **Presentation: Pathogen Destruction Studies**
from Blair Institute
by Mr. Morris Chidavanzi

11:45 - 12:30pm **Presentation: Dream City**
Nampula Mozambique
by Mr. Bjorn Brandberg

12:30 - 1:00pm **Assignment of Group Work:**
The Way Forward for Ecological Sanitation
by Mr. Obiero Ong'ang'a

1:00 - 1:30pm **Group work**

1:30 - 2:30pm **LUNCH**

2:30 - 3:00pm **Continuation of Group Work**

3:00 - 4:00pm **Group Presentations:**
1. Technology/Pathogen Destruction
2. Social & Behavioural aspects / Health & Hygiene
3. Application for Agriculture & Forestry / Resource Mobilisation
4. Regional Networking / Communication

3:55 - 4:30pm **Discussion, Synthesis, Wrap Up**
by Mr. Brendan Doyle

4:30 - 4:45pm **Close of Workshop**
by Mr. Abednigo Chigumbu

ANNEX II

Country Experiences in Ecological Sanitation

Ethiopia: Economical Ecological Sanitation (ECOSAN)

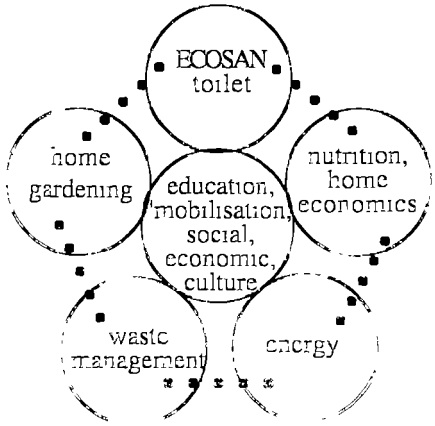
by Ms Almas Terrefe & Mr. Gunder Edstrom, SUDEA

1988	SEPTUM, trade marked in Sweden by the University of Umeå
1989	Project proposal to SIDA from Dr. Torsten Modig. Suggestion: introduce a new sanitation system based on recycling in Africa (rejected)
1992	Almaz and Gunder in Ethiopia, asked to come and work with sanitation
1993	Dr. Modig, Almaz and Gunder in renewed discussions with SIDA
1994	Dr. Modig, Almaz and Gunder in Ethiopia with a demonstration box and a draft project proposal. System named ECOSAN (economical, ecological sanitation) Positive reaction from DISOP in Belgium SUDEA forms an advisory group of scientists
1995	Ethiopia-visit by Almaz and Gunder and project proposal to SIDA and DISOP Rejected by SIDA - exaggerated value of urine and transport not by vehicles but with donkeys or humans DISOP approves on condition that SIDA takes 15% and Ethiopia 10%. New discussions with the SUDEA scientific advisory group New discussions with SIDA and they approve to take 15% of the costs
1996	Pilot project starts in Addis Ababa and Harar, Ethiopia. A corruption scandal in Belgium stops the Belgian money for SUDEA
1997	Workshop arranged by Sida at Balingsholm. Representatives from about 30 countries discuss Ecological Alternatives in Sanitation (Botswana, China, El Salvador, Ethiopia, Japan, Kenya, Mexico, South Africa, Vietnam, Zimbabwe etc.) A statement from the workshops promotes a new sanitation system to be introduced - eco-san. The basic ideas are identical with the ones in SUDEAs project proposal! New discussions with Sida: prepared to take over the financing after Belgium
1998	New ECOSANs with urban agriculture or home gardening built in Ethiopia. Dr Peter Morgan on a knowledge-exchange-visit, and he is enthusiastic Almaz and Gunder on a return visit to Zimbabwe and also to Botswana and Mexico ECOLILY and ECOPIT developed in Ethiopia
1999	University course in Linkoping, Sweden, on Ecological Alternatives in Sanitation WEDC conference in Addis and ECOSAN days in Zimbabwe New type of toilet seat (sitting or squatting) developed and a urinal from porcelain produced in Ethiopia Mud-block ECOSAN developed for the World Bank

ANNEX II

ECOSAN
Economy, Ecology, Sanitation

ECOSAN
the recycling sanitation system



Introduction
target groups
ECOSAN and gender
partners
selection
socio-economic and cultural aspects
assessment
respect

Materials and techniques
siting (choose place)
material
cost benefit
durability
comfort, exterior
knowledge exchange
usage - nonmixing, ashes, soil and leaves, anal cleansing
cleaning

Household/urban agriculture
space
techniques (FAITH, DD, GW, CG)
fertiliser (urine, faeces, organic wastes)
seeds/seedlings
culture

Waste management
household waste
garden waste
grey water
sorting at source
composting
collecting (NBD)
drying
who should do the composting?

Nutrition
new cookbook (raw, time, taste, planning)
energy
training

Prerequisites of success
knowledge
support, solidarity
acknowledgement
co-operation
consultation
cultural sensitivity
participation
communication
self-evaluation
evaluation

Economic value of urine and faeces as fertilisers
Estimated from the chemical content of urine and faeces
= US$8.60 per year

Fertilising effect tests
made on swiss chard at Bethlehem Training Centre, Addis Ababa with a urine dose corresponding to 380kg N per hectare show a 4 times higher biomas than the control.

ANNEX II

Kenya: Ecological Sanitation as an Option where Sewerage Systems Malfunction (the Kisumu Case)

by Mr. Kinya Munyirwa, MPhil/PhD Student
and Mr. Obiero Onganga PhD,
OSIENALA (Friends of Lake Victoria)

Introduction

Sewerage remains by far the most expensive sanitation technology and in developing countries its costs continue to rise. Sewerage demands increasing water consumption levels which make it unfeasible in many urban areas. According to WHO (1997) and Briscoe & Steer (1993), more than 90% of all sewerage in developing countries is discharged without any treatment. Conventional flush toilets and sewerage have been successful where financial, technical and managerial resources are available. However in the Third World it is not a good option because of rapidly growing populations (over 3% a year due to rural-urban migration) and inadequate water supply.

Findings are presented here from the participatory baseline study carried out from August 1998 to February 1999 in two contrasting peri-urban neighbourhoods of Kisumu. Manyatta is a mixed slum dwelling approximately 1.875 km2 located about 4 km to the south of north-east from the town centre. It is a relatively old estate dating back to colonial times. Migosi on the other hand is a relatively affluent, middle class neighbourhood covering 0.875 km2. It is approximately 4.5 km in the north of north-east from the town centre. In Migosi flush or pour toilets dominate but house owners feel that without tap water it is not a good option. Manyatta and Migosi are in close proximity, separated by the road to Kisumu-Kibos. The study was carried out by researchers with technical support from Linkoping University, Sweden and with funding from Sida.

The area of studies were:

- Well-water quality monitoring and analysis
- Resident's perception of water, sanitation and urban agriculture and
- Spatial perspectives of pit latrines, water wells and assessment of groundwater recharge and well yields against efforts.

Background

Kisumu, with a population over 650,000, is the third largest city in Kenya. It is on Lake Victoria, the second largest freshwater lake in the world and the largest in Africa. Most of its residents rely on well water for household purposes. Effluents from some 100,000 people connected to sewers are emptied untreated into the Lake at the shallow Winam Bay.

Inadequate municipal water supply has forced residents of Kisumu to take action for themselves by digging wells and pit latrines throughout the town. Such own-key arrangements have included the development of on-site

sanitation facilities such as the digging of pit latrines, septic tanks and other local ways of excreta disposal. Providing ever larger urban populations with piped system sewerage has proved impossible, not only in Kusumu but in most of the cities of developing world. Groundwater is the main source of household water, seasonally complemented with rainwater harvest.

Because the population density is high, and because many people use pit latrines, groundwater pollution can be high as evidenced by high faecal coliform counts in some wells. Combined with the fact that burst sewers leak for months and the water table is very high, it is inevitable that groundwater in Kisumu is often grossly polluted.

Results

Survey of faecal contamination of dug wells

One hundred shallow wells (50 in Migosi and 50 in Manyatta) were surveyed and sampled. Out of the 100 sampled, 47% showed faecal contamination of above 10/100 ml of water. This is sufficient evidence that Kisumu shallow wells are contaminated and appropriate mitigation measures need to be in place. However, there is a need to monitor changes in faecal contamination when dug latrines are being replaced by ecological ones.

Mapping Exercise

Intensive mapping carried out during the study recorded densities of 958 and 349 pit latrines per km2 in Manyatta and Migosi respectively. Numerous wells have also been dug in an attempt to compensate the inadequate Municipal water supply. The maps included home gardens and small fields used for urban agriculture. In Manyatta alone there are 1,913 pit latrines and 321 wells, while Migosi a total of 305 pit latrines and 58 water wells were mapped. Population density of Manyatta stands at 12,638 (CBS, 1989) persons per square km.

Estimation of groundwater recharge to assess yields expected from existing wells

The source of water utilized by residents of the study area was mainly from wells since potential water supplied through the municipal piped water supply system was only 15% of the relative water demand of the neighbourhood. The consumption of rate of 427,062m3/year and recharge from rainfall is less than estimated yields of 657,000m3/year. This finding implies that the aquifers in the study area are recharged from points far from the study area.

The residents in the two peri-urban settlements proved willing to contribute to the project by replacing dug latrines with ecological sanitation systems and continuing to improve their wells.

Residents Perceptions of Water, Sanitation and Urban Agriculture

Perception about faeces and urine were varied. Urine seemed to be of little significance and had a bad smell which made well owners feel that it contained acid. It was not however seen as similar to water or urine from other animals. Faeces on the other hand was generally seen as offensive and difficult to handle especially amongst male adults. When mixed with animal manure it was perceived as less repulsive. This was only noted amongst few people. However, because such cases already exist, these could be used as a spring board to widen understanding and changing attitudes.

The interviews revealed that open spaces were very limited and may not allow much on site recirculation of nutrients in faeces and urine. The big challenge is to find places where the same can be transported to in trucks or bicycles or through sewers for urban agriculture in other places. The owners of limited spaces available were however willing to be used as demonstrators on the capability and benefits of ecological sanitation. More mobilisation will need to be intensified since there is no intensive agriculture going on in the neighbourhoods but a reminiscence of past agricultural practices.

The Option: Ecological Sanitation Development

Ecological Sanitation is however seen as the sanitation option to succeed in the peri-urban area of Migosi and Manyatta where the water table is very high and shallow wells are the main source of drinking water. It should be emphasised at this point that with current inadequate water supply services from Kisumu Municipality, well water will continue to be used and therefore needs to be protected at all costs.

To date 15 ecological sanitation toilets have been constructed in the project area. The type introduced in Kisumu are urine diverting, also known as no-mix or dry toilets. Although locally assembled, the technology was introduced by Dr. Peter Morgan from Zimbabwe, the "guru" of the VIP, recently converted to ecological sanitation. The toilets are made from plastic buckets existing in the market covered with cement mortar on the outside to provide strength.

The urine diverting systems are based on toilets with a divided separator bowl, the front chamber collecting urine and a rear one collecting faecal matter. Urine is stored in 20 litre jerricans which are periodically emptied to a larger tank for use as farm fertiliser.

It is important to note that if urine is kept separate from faecal material the number of practical options for disposing excreta multiplies. If it is composted for six months all pathogens and most ova will have perished and the product is harmless.

The principles behind this new option are:

Do not mix urine and faeces - *keep separate*!
Do not flush away faeces - *dehydrate*
Do not waste a valuable resource - *fertilise* *(Winblad, 1998).*

Ecological sanitation does not pollute groundwater thus permitting its continued use as household water (unless polluted by industries or others). Urine-diverting toilets are odourless and can be installed inside houses. Some of the appreciated benefits from having the toilet inside is that the household can control who is using it and also it is safe to use at night.

OSIENAL has been impressed by local efforts. It hopes that with care, assistance can be given to further promote local initiatives so that greater numbers of people can be served by improved quality water within the municipality of Kisumu.

Evaluation Results

In the evaluation study carried out on proper use of the urine diverting toilet in the project area, 8 out of 15 families were using the toilets properly; 4 out of 15 families were using them improperly; and 2 out of 15 families were not using them at all.

Immediate Plan

Research on the value of separated products of human excreta for promotion of agriculture and hygienic aspects of their re-use in tropical climates:
In this proposed study human excreta will be regarded as a resource to be recycled rather than a waste to be disposed of. The nutrients recovered from human excreta especially, nitrogen phosphorus and potassium are to be used to enhance the productivity of horticulture and agriculture in the kitchen gardens in urban as well as in rural areas. Declining soil fertility reduces food production and disposal of nutrients into rivers and lakes, destroying aquatic environments and resulting in declining fish catches. Nutrient pollution destroys different life forms and reduces the diversity of life. Bio-diversity provides us with the raw materials for our food supplies. No amount of human ingenuity and technical know-how can solve these problems if human excreta continues to be viewed as a waste for disposal. We need to take a holistic approach, recycling nutrients to the land. An ecosystem approach of "Ecological Sanitation" is needed.

Research in the fields of pathogen behaviour, post-treatment and agricultural use of dry toilet products, as well as anthropological studies which help to identify family and people's perceptions and roadblocks will be pursued. The following institutions will collaborate: Linkoping University, Swedish Institute for Infections Disease Control, Uppsala University of Agriculture

all from Sweden, Nhatrang Pasteur Institute, Vietnam, Espacio de Salud in Morelos, Mexico and Maseno University College, Egerton Agriculture University, Kenya. The initial funding to set up the experimental site for research has been provided by RELMA.

Lessons Learnt from the Study Phase

- The problem of Ecological Sanitation is not the technology itself, but the interaction between technologies and users. Therefore at the household level individuals and families must understand how ecological sanita tion systems work, what can go wrong and have the commitment and the skills to manage it carefully. Users must be aware that despite potential health benefits, improper use of any toilet system may turn it into a nuisance, threatening public health and pollute environment. This can be avoided by adopting the appropriate behaviour from the onset.
- Taboos may fade away with awareness-creation and related training activities.
- Change of attitude is a process which requires effective education, awareness and training. The element of awareness-creation and training is very important in the programme implementation.

What has been achieved

Major achievements have been generated to reduce poor sanitation and health risks in the project area. The concept of ecological sanitation has been promoted and is finding acceptability among users, community organisations, local government, professionals, local as well as foreign academic and research institutions.

Conclusion

If urine is kept separate from faecal material the number of practical options for disposing excreta multiplies.

South Africa: The Campbell Experience

by Mr. Richard Holden, Mvula Trust

ANNEX II

Mvula Trust can hardly say it has more experience of ecological sanitation than does Mvuramanzi. CSIR* began piloting and research on ecological sanitation in the Eastern Cape, Umtata while Mvula Trust began in the Northern Cape. CSIR had seen examples of ecological sanitation in Sweden and wanted to see if urine diversion and reuse and use of composted faeces were acceptable to people in agriculture in South Africa. They also undertook research in pathogen destruction. Mvula had seen examples of ecological sanitation technologies and began by replicating a urine diversion pedestal latrine seat to replace a bucket system already in existence.

* CSIR (formerly Centre for Scientific and Industrial Research, South Africa Government parastatal agency, now called the Division of Building Technology)

CSIR started by building 30 fully subsidised diverting latrines but they were very expensive. There was no problem with acceptability by local communities and men preferred the separate urinal (but which alone cost US$20). However when it came to reuse it was found that no one was prepared to use urine as fertiliser. As a result the systems divert urine to a soakaway pit. There was no problem with the faeces however, and now the first composted faeces are being used in gardens as a soil conditioner. People say "Cow dung? Human dung? What's the difference?".

One early finding has been that because there is not a controlled environment in the latrines, there is enormous variation in pathogen destruction from pit to pit. Tests show that the pathogen destruction rate between household latrines varies. Mvula is investigating what the cultural, physical, climactic and social variables might be to affect this. It is hoped that this research will help us in the future to design better systems and programmes.

The Northern Cape has a hard rock surface and is quite barren in areas with no bushes or trees. In this area people traditionally mixed urine and faeces in a bucket latrine system. The buckets were supposed to be collected once a week but this was not reliable. People were therefore desperate to get away from the disgusting system and willing to try any alternative. As a result Mvula began to construct raised VIPs starting with a few prototypes. The technology was acceptable but the social side wasn't because everyone could see where someone was going when they went to use the latrine: it wasn't very private.

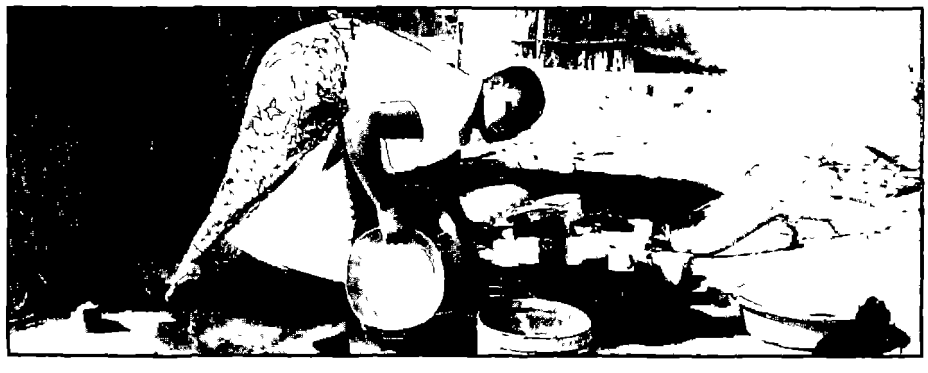
Mvula saw the Mexico pedestal in Sweden Knowing there was a "sitting" culture in SA as opposed to a "squatting" one, the moulds were imported into South Africa. Installation has begun on a large scale since last year. It has not been a problem to get people to accept urine diversion. The concept was easy to grasp even though no one was prepared to use the urine, so it is left to soak away. Mvula has concentrated on the reuse and management of faeces instead. One project has now been running for ten

months in the Campbell community and people have made sure that urine diversion works. Since they use [telephone directory] yellow pages and newspaper as toilet paper they were advised to throw a match down the latrine after a few months and just burn the stuff. This elevates the temperatures in the pit and dehydrates the faeces to such an extent that the pit has not had to be emptied. However some problems have been experienced with some people who are not prepared to manage the faeces.

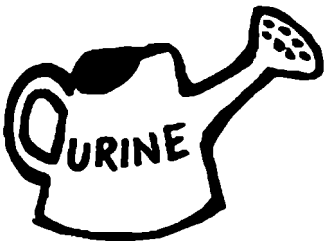
The Umtata Projects on the other hand have no problem with faeces management. It may be that they have had more education on the issues involved, although we've found that some people in the community started off by saying that it's good, then changed their minds, and are now going back to saying "yes" [the system is good].

The problem with urine diversion at the beginning was getting a man to sit down to pee. This was solved with the introduction of an expensive urinal, which was not affordable for most households. Now Mvula is experimenting with ways to get people to urinate into a jerican placed next to the toilet. Men can stand up and use this and when it's full they can carry it away for emptying. The problem with putting a jerican under a pedestal is that you have to raise it really high or use a smaller container underneath which fills up too fast. The jerican option is now ready for introduction to the community

On the issue of hand washing, up to now people use containers with a twig inserted in a hole in the bottom but there have been problems in households with young children who tend to leave the twig out of the container. When all the water is gone it tends not to get replaced especially if it's a big container because who's going to fetch the water again several times a day? Mvula is working on developing a 2-litre plastic bottle water dispenser with a small push-up valve that automatically closes when it is let go. Even young children can use this correctly and 2-litres of water can last a family for a whole day of hand washing. This will be tested to see if it solves the problem and Mvula is looking for ways to have the bottle manufactured at low cost. Milk bottles are widely available so we think this can be done.



Questions & Answers



Q: Do they [people in your projects] reuse waste faeces?
A: Umtata are reusing it in gardens, but in Campbell they burn it after 10 months. No waste has been generated so far because the new latrines have such big pits they will take a while to fill.

Q: In the use of jericans for urinating I have two problems: contamination of the can on the sides, and the ammonia smell from the open can. Won't this turn people away [from using it]?
A: Sometimes people do miss and urinate on the sides just as someone does with a conventional toilet. But the jerican has a big funnel on top and if you miss, its same as any other toilet, clean it up! As far as the smell, a top gets put back. If you find something to block the opening it solves the problem.

Q: You said [the rate of] pathogen destruction varies: do you have to keep turning it [the fecal matter]?
A: You are supposed to pull it back [rake the faecal matter back in a heap]. The rate of "die off" of pathogens varies greatly and this appears to be [caused by] what's chucked down the toilet [added to the faecal matter in the latrine]. If you mix it with soil it helps accelerate the destruction. But in this situation we're purely dehydrating [faecal matter] not composting.

Q: Can women use the jerican? How culturally appropriate is this?
A: I have a laptop presentation showing how women can use this at the back of the room [laptop shows woman in semi-squat stance over the jerican funnel].

Q: Regarding the cost of various options, can you repeat that again?
A: When CSIR provided everything it cost about US$600 a unit. We're looking at replicability with US$8 for a pedestal and $4 for a slab. This is the minimum needed to get urine diversion to work. The other stuff is optional.

Q: On acceptability, in Umtata and Campbell, people didn't accept to reuse [faeces and urine]. Did you explain the concept to them? Did they buy just the toilet or were they aware of the reuse concept?
A: Different approaches were used between Umtata and the Northern Cape. In the Umtata they were looking for reuse and so people are reusing. In the Northern Cape they were looking for an alternative to a bucket toilet.

The question is what to do with it [the faecal matter]? Some people just chuck it in the rubbish bin after it's dried out, others use it in their gardens and this varies from community to community. They were looking for a viable alternative to pit latrines and buckets because of the problem of hard rock, not reuse.

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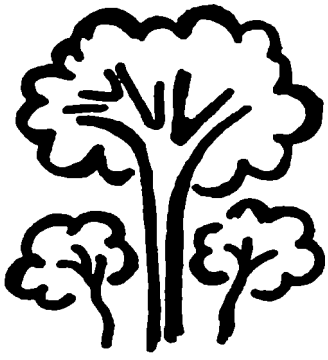

Zimbabwe: A Brief Overview of Ecological Sanitation

by Mr. Peter Morgan, Aquamor

Definition of Ecological Sanitation in Zimbabwe

Ecological sanitation is seen in Zimbabwe as a system that makes use of human waste and turns it into something useful and valuable with minimum risk of pollution of the environment and with no threat to human health. It is a system in which latrines are designed to:

- store and prepare human waste from use in agriculture by encouraging the formation of humus by the addition of wood ash and soil etc.
- provide a means of removing the human waste safely and simply from the latrine to another site of composting
- reduce the pollution of the ground and atmosphere as much as possible
- it is the reuse of the end products which is vital, they must be introduced into agriculture or forestry in a simple and effective way which is safe.

In ecological sanitation the worlds of sanitation and agriculture come together in a way which is beneficial to man by turning a waste product into something valuable.

Latrine types used in Ecological Sanitation in Zimbabwe

Shallow pit latrines

Arborloo - simple latrine with a portable latrine slab and superstructure which is mounted over a shallow pit. Used pits are planted

Fossa alterna - simple latrine with a portable slab and superstructure which alternates between 2 permanently sited pits at 6 month intervals.

Urine diverting latrines

Urine diverting latrines - with vault above ground or below ground. Solids held in vault or in container (bucket, basin etc.). Bucket/basin contents transferred for further processing to composting site. These can be converted VIP's latrines with single or double vaults. They can be multi-compartment latrines fitted at schools.

(Note: urine-diverting pedestals are commercially available but a number of "home made" units have also been built).

Non-urine diverting latrines

Modified VIPs with single or double vault. If double, one vault is used at one time and the latrine floor is designed with two squat holes, one of which is converted at any one time. The latrine vaults are designed for relatively easy access to contents.

(Note: All latrines used in ecological sanitation are designed to store and prepare human waste for use in agriculture by encouraging the formation of humus by the addition of wood ash and soil etc.).

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Methods of introducing human waste into agriculture

- Shallow latrine pits (*arborloo*) for tree planting
- Humus making latrine pits (*fossa alterna*) for humus production
- Fertility pits or trenches (organic pits and eco-pits) for humus production or vegetable/tree planting
- Tree pits specifically for tree planting
- Trench pits for vegetable production
- Bags for storage and humus production
- Buckets for storage and humus production or vegetable/tree planing
- Compost heaps for production of garden compost
- For urine, directly on to or into soil or diluted 10:1 with water and water plants directly.

The world of sanitation and agriculture come together by changing an eerie smell into something useful. When the programme began there were only pit latrines, which could be converted into ecological sanitation latrines.

Defining ecological sanitation

Other definitions of ecological sanitation have been developed in Sweden and Addis. The definition may be debated later but we should remember to be flexible on this. And in this workshop there will be many debates. The latrines you will visit in the field are designed so that the final materials can be used in agriculture. We wanted sanitation and agriculture to come together in a way that is of value to Zimbabweans.

On the softer side

The software component to this is vital: we need to work on the social side of things. Over the next few days you'll see what's been tried in Zimbabwe. We were told in Sweden that we must separate urine and faeces, however in this country we are looking at other techniques as well. The simplest way we've found is the arborloo, a portable latrine where the matter is left in site in shallow pits in which trees are planted. Some people have argued that this may be a source of pollution, but the pits are very shallow and are only used in areas not prone to flooding or high water tables, minimising the risk of groundwater or surface pollution.

Another example you will see on the field trip is the ***fossa alterna***, a pit which alternates. The central thing is that the pits are shallow and the contents are a mix of faeces, soil and wood ash which promotes rapid decomposition. Some latrines you will see have urine separation and use pedestals. These include newly developed as well as adapted VIP latrines (some have been converted to become more like composting latrines).

ANNEX II

Zimbabwe: Pathogen Destruction

by Mr. Morris Chidavanzi, The Blair Research Institute

Discussion

The analysis will determine the decay rate with age under varying composting or natural treatment conditions The pathogen decay model shown here will be used to recommend safe excreta use / handling practices under varying conditions ash (alkaline), sand (aerobic), soil (less aerobic), natural (control)

Pathogen Decay During Storage and Composting

(with Mr M Jere)

Introduction

Pathogenic destruction seeks to develop and understand the rate of decay during composting of pathogenic micro-parasites and helminths found in human excreta and the health aspects of handling and using such products.

Objectives

The study focuses on the estimation of the rate of decay of pathogens under aerobic composting; estimation of the rate of decay pathogens in conventional pit latrine chambers; and examination of the rate of decay under varying conditions of temperature, humidity and soil pH.

Materials And Methods

Sample materials originate from low cost latrines designed to divert urine from faeces. Raw faeces are mixed with ash, sand, soil and other organic matter and allowed to compost. Samples are then collected every month from the compost sites for laboratory analysis. The samples are collected in tight lid containers, and taken to the laboratory for processing .

Procedure

1g of compost sample is weighed and diluted into 9ml of 0.1% peptone water to give serial dilution factors (to the power of 10). 0.1 ml of the dilution is pipetted on the surface of Mac Conkey agar plates and spread with a sterile glass rod. The spread Mac Conkey agar plates are incubated for 18 to 24 hours at 37oC. All colonies resembling E.coli (Type 01) morphology are counted and confirmed for the actual species by carrying out bio-chemical tests using the Analytical Profile Index (API 20E reagent test stripes).

Results 17/09/99

Sample No. & Name of User	PH	0	1-1	1-2	1-3	1-4	1-5	1-6	M/count x10-6	Confir-mation	%
1 C Chigwamba	7 35	TN	TN	8008	1120	273	39	2	1 97	E coli	99 2
2 S Chigwamba	8 36	TN	TN	TN	286	192	47	5	3 0	E coli	99 2
3 Kapondoro	8 59	TN	TN	1566	158	10	2	0	0 15	E coli	90 9
4 Woodhall Farm		TN	TN	522	392	44	0	0	0 44	Pstria spp	87%

KEY TNTC = To numerous to count / E.coli = Eschericihia coli

Research Proposal on the use of Human Waste "Night Soil" as a Fertiliser and Soil Amendment in Rural Zimbabwe

by Mr. B. Mashingaidze and Mr. P. Tongoona,
Crop Science Department, University of Zimbabwe

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Purpose

The aim of this study is to determine the nutritive and soil amendment value of products from eco-sanitation technology (urine and composted faeces) for cereal crops commonly grown in the smallholder sector in Zimbabwe. This is a part of a larger study on the promotion of eco-sanitation which cover aspects of safety and pathogen decay in composted human waste from eco-sanitation technology, social and behavioural acceptance, eco-sanitation technology refinement and communication/advocacy strategies.

Specific objectives

- Determine the composition of products from eco-sanitation technology (urine and composted faeces).
- Quantify the effects of the products from eco-sanitation technology (urine and composted faeces mixtures) on the growth and yield of maize and sorghum in comparison with commonly used inorganic fertilisers.
- Determine the mineralisation (mineral NPK release patterns) of products of eco-sanitation technology during the season and over a three season period of application.
- Determine the effect of application of products of eco-sanitation technology on the soil physical characteristics (water holding capacity, aggregate stability, porosity, penetrability, infiltration).

Background

In a recent diagnostic survey of the smallholder agricultural sector, exhausted soils depleted of their natural mineral and organic constituents by years of cropping with little fertilisation or manuring were cited as one of the major problems contributing to low yields and poor food security in this sector in Zimbabwe (Smallholder Dry Areas Resource Management Project, 1998). Inadequate draft power, frequent drought and inability to purchase cropping inputs are other contributory factors to low food security in the smallholder sector in Zimbabwe.

The poor farm families in the smallholder sector are generally those that do not own sufficient livestock numbers to carry out timely tillage, plant early and achieve high crop yields. This means that these poor farmers have no or little access to animal manure. Since they, generally cannot afford to buy the expensive inorganic fertilisers, over a number of years they have, invariably, mined their lands of the little minerals and organic matter originally found in the granite derived sands found in most communal areas of Zimbabwe *(Grant, 1981).*

The precarious food security of the poor farmers in the smallholder sector means that they fail to produce enough food from their allocated land in the communal or resettlement areas to feed their families until the next harvest.

They therefore go hungry for a proportion of the season and traditionally rely on free food hand-outs handed out by the government to carry them through to the next harvest Now that the grain loan scheme has been terminated by government, these farmers face a particularly bleak future unless their soil fertility and concomitant food security problems are ameliorated

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Despite all the knowledge that the human race has accumulated in the past 10 000 years, humankind still has not mastered how to use human urine and faeces to fertilise farmlands in a way that is simple and efficient, will not spread disease and that will benefit the soil

This knowledge is becoming increasingly important as soils continue to be depleted in minerals and organic matter they need to remain fertile (Beeby, 1995).

The low organic matter content of the exhausted sandy soils in the smallholder sector in Zimbabwe is inimical to aggregate stability and predisposes them to the rampant soil erosion and land degradation that is characteristic of the communal areas today *(Elwell and Norton, 1988).* Cheap and readily available sources of plant nutrients and organic amendments are therefore urgently required to turn around the deterioration in soil fertility, to improve crop yields and to ensure food security.

Potential for a new source of fertiliser

Decomposed human faecal matter and urine from eco-sanitation toilets could be readily available in the smallholder sector in Zimbabwe and could potentially be exploited as a fertiliser and soil amendment. The proposed study is therefore an attempt to adapt the use of human excreta to solve the low fertility and poor soil structure problems and enhance food security in the smallholder sector in Zimbabwe using a readily available resource in the community.

Fertiliser value of human faeces

The quantity and composition of human excreta, wastewater and solid waste varies greatly with location depending on food diet, socio-economic factors and water availability. Faechem et al. *(1983)* found that the quantity of faeces produced per capita daily in some European and North American cities was 100-200g while that in developing countries was it is between 130 and 500g (wet weight) per capita daily. Most adults produce between 1 and 1.3 kg urine, depending on how much they drink, and on the local climate. The water content of faecal matter varies with the faecal quantity generated, being between 70 and 85 per cent (see Table 1).

Table 1: Composition of human faeces and urine

	Faeces	Urine
Quantity (wet) per person per day	100-400g	1.0-1 31kg
Quantity (dry solids) per person per day	30-60g	50-70g
Moisture content	70 to 85%	93 to 96%
Approximate composition (% dry weight) organic matter	88 to 97	68 to 85
Nitrogen (N)	5 0 to 7.0	15 to 19
Phosphorus (as P2O5)	3.0 to 5 4	2 5 to 5 0
Potassium (as K2O)	1.0 to 2.5	3 0 to 4.5
Carbon (C)	44 to 45	11 to 17
Calcium (as CaO)	4.5	4 5 to 6.0
C/N ratio	approx 6 to 10	1

Adapted from Polprasert (1989) and Feachem et al. (1983)

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The aim of this study is to investigate the effects of decomposed human excreta from eco-sanitation toilets on plant growth yield and soil characteristics. Crops whose harvested economic parts do not normally come into contact with treated soil will be used in these experiments to ensure that the dangers of pathogen transfer from decomposed excreta is minimised. Maize is the staple food crop in the smallholder sector in Zimbabwe and is grown throughout the country, even in dry marginal areas *(Mashingaidze and Mataruka, 1992).* Sorghum is grown in the drier regions of Zimbabwe.

In the rural areas of Zimbabwe where water-borne sewage systems are absent, human excreta is commonly treated by on site methods such as pit latrines and Blair toilets However these methods make it hygienically impossible to re-handle the waste and use it as a fertiliser because it is septic, produces highly objectionable odours and poses an unacceptable health risk

For human waste to be accepted and adopted for use as a fertiliser & soil amendment it must be seen to be safe and non-objectionable to handle and apply to crops in the field Hence this study will go hand in hand with the pathogen and helminth decay studies which will be carried out on the composted products from eco-sanitation toilets.

Materials and Methods

1. Determination of composition of decomposed human excreta

Protocols specified in Anderson and Ingram *(1993)* will be used to analyse the human samples of decomposed human excreta and urine from eco-sanitation toilets. Nutrient content (total phosphorus, potassium, magnesium and calcium) will be determined by ashing the excreta followed by digestion with a mixture of hydrochloric acid and nitric acids. Magnesium and calcium will be analysed using the atomic absorption spectrophotometer while potassium and phosphorus will be analysed using a flame spectrophotometer. Total nitrogen will be determined by the modified Kjeldal method based on wet oxidation and conversion of organic N to ammonia by digestion with concentrated sulphuric acid followed by colometric determination of ammonium. Mineral nitrogen will be extracted with 2M potassium chloride and determined colometrically. Moisture and dry matter content will be determined conventionally. A sample of the material will be dried at 105 0C for 24 hours.

The residue will give dry matter or solids content while the loss in weight is the moisture content. To determine the organic matter and ash content, samples will be ignited slowly to a final temperature of 450 0C in an electric furnace. The loss in dry weight will give the organic matter content while the residue represents the ash content. Carbon will be determined from the relationship; total C = (organic matter content)/1.8 (Haug, 1980). Available phosphorus will be determined by the Bray method based on the extraction of phosphorus with a mixture of NH4F and HCl and the development of colour with acid ammonium molybdate. The pH and electrical conductivity will be measured in a CaCl2 (1:5) extract using a pH and conductivity meter, respectively. The date coded urine and decomposed faecal matter will be provided from the other components of the study (the eco-sanitation component and the pathogen decay studies).

2. Effects of decomposed human excreta and urine on plant growth and yield, soil physical attributes, mineralisation and residual effects

The experiments will be carried out at the University of Zimbabwe Farm (heavy red fersiallitic soils) and Domboshava (sandy soil site).

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The following treatments will be used:

1 Untreated (control)
2 1 tonne/ha composted faecal matter
3 2 5 tonnes/ha composted faecal matter
4 5 tonnes/ha composted faecal matter
5. 75 kg /ha Compound D plus 75 kg Ammonium Nitrate "AN"
6 150 kg/ha Compound D plus 150 kg "AN"; 7 300 kg /ha Compound D plus 300 kg "AN"
8 Urine diluted at 10 1 with water applied at 10 litres per m2
9 Urine diluted at 15 1 with water applied at 10 litres per m2
10 Urine diluted to 20 1 with water applied at 10 litres per m2

The composted faecal material and urine will be provided from other components of the study. The experiment will be arranged as a randomised complete block design replicated three times at the two sites for maize and sorghum. Fertiliser and composted faecal matter will be broadcast and incorporated into the soil by discing to a depth of 20-30cm. Plot size will be 2.7m width x 3m length which will accommodate four maize and sorghum rows at 0.9 m spacing. Two middle rows will be harvested for yield assessments at the end of the season as nett plots. Maize and sorghum will be planted in separate experiments at the two sites. Soil samples will be collected before planting, and every four weeks after planting and plant available or mineral (N, P, K) determined as previously described in 1.

A representative sample of plants from the treatment plots will be harvested every three weeks and plant height, leaf area per plant, total plant dry weight, leaf dry weight and stem/petiole dry weight determined until the flowering stage. Time to tasseling, pollen shed and 50% silking will be recorded. Grain yield adjusted to 12.5% moisture content will be determined at the end of the season. The treatments will be applied to the same plots for three seasons and similar measurements described above taken every season.

Soil samples will be taken from the treatment plots before application of the human excreta and fertiliser amendments and at the end of the season and bulk density, water holding capacity, infiltration (double ring method), and porosity determined as described by Anderson and Ingram (1993). Residual benefits to the soil physical characteristics will be similarly monitored in the second and third year of the experiments.

3.Effect of composted faecal matter and urine top dressing on plant growth and yield

The experiment will be carried out at the University of Zimbabwe Farm and at Domboshava. The following treatments will be arranged as a 3 x 3 factorial in a randomised complete block design. The urine will be applied as a top dressing fertiliser at 5 weeks after planting.

Table 2: Treatment combinations in an experiment measuring the effect of faecal matter rate of application and top dressing using urine on maize and sorghum

Fecal matter application rate (F) Urine top dressing (U)	***1 tonne/ha***	***2.5 tonnes/ha***	***5 tonnes/ha***
5 litres/ha	F1 U1	F2 U1	F3 U1
10 litres/ha	F1 U2	F2 U2	F3 U2
15 litres/ha	F1 U3	F2 U2	F3 U3

Measurements on plant growth and development, soil nutrient dynamics and crop yield will be as in experiment 2. The urine will be diluted 10:1 with water to enable even application in the field.

4. Effect of faecal material and urine mixtures on growth and soil characteristics

The experiment will be carried out at the University of Zimbabwe Farm and Domboshava. The experiment will organised as a 3 x 3 factorial in a randomised complete block design with 3 replications. The treatment combinations are similar to those shown in Table 2 above with treatment combinations measuring the effect of composted faecal matter and urine mixtures on maize and sorghum. The composted faecal material and urine will be thoroughly mixed before application and incorporated 20-30 cm into the soil before planting. Measurements will be made on plant and soil parameters as in experiment 2.

ANNEX III

Ecological Sanitation

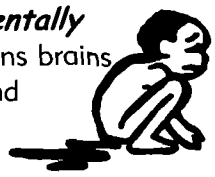
solutions to mounting global problems

by Ms Regina Doyle & Dr. Steve Esrey

1. What's the problem with human faeces?

Actually the harmful living things in faeces, not faeces themselves are the problem The effects of unmanaged faeces:

Kill children 3 million die globally every year of diarrhoeal diseases.



Stunt children, mentally and physically diarrhoea weakens brains and bodies, causes feebleness and learning difficulties.

Make children and adults ill with diarrhoeal, parasitic, skin and other diseases.

Burdens women and girls who by tradition have responsibility for the sick and household cleanliness.

Cause loss of income sick people work less, medical and funeral expenses increase, school fees are wasted and costs of poor sanitation are high.

Damage the environment faeces pollute water, add to global warming, cause loss of bio-diversity and lead to over-use of precious water.

Pile up Sanitation facilities waste land space and resources and make the world dirty and smelly!

Holds back national development reduces agricultural production, keeps workforces below peak, leaves potential brainpower unrealised, increases health costs and discourages or destroys tourism.

Recent cholera alerts caused European Union bans of shrimp & fish imports from Mozambique & Uganda. Disease outbreaks, obnoxious odours and pollution force closures of holiday spots or required massive cleanups. Such incidents cost millions of dollars in lost revenue.

2. Why is this happening?

We "share" faeces and put it back in our bodies.

Faeces are scattered in and around homes, fields and water and put where it is shared with others It gets onto our **hands** by wiping after defecation or by touching other hands, doorknobs, money or anything else with faeces on it. It gets into our **food** through dirty hands, plates, utensils, and raw or improperly cooked provisions. It gets into our **water** when we defecate into it, wash nappies and bathe in it, dump sewage and let pits leak into it. Parasites burrow into our skins when we share water with faeces and urine in it.

The harmful germs in faeces can live on our hands for many hours after being picked up.

We feed & breed faecal germs and worms.

Harmful living things in faeces need food, warmth and moisture to grow and reproduce. When they get back into our bodies, we keep them alive and help them multiply When we mix faeces with urine we provide it moisture and nourishment. Wet, warm, dark, dirty sanitation systems help keep faecal germs and worms alive as long as possible.

We "stockpile" faeces.

Improperly contained piles of faeces, especially when mixed with urine, attract flies and other vermin Such stockpiles are taking up more and more space in our homes, our municipalities and our planet. Resources are being consumed in construction of more facilities to contain it and transport to move it.

140 grams per person per day
x 6 billion people in the world
x 365 days a year is a lot of faeces!

We over consume and pollute fresh water in an attempt to "get rid" of "waste"

We use fresh water to soak or flush faeces and urine away. We excrete directly into streams, rivers and lakes, or it washes out of the bush. It seeps out of latrine and septic pits or is dumped into water by sewage systems. Over 80% of all sewage (toilet, bath and kitchen water mixed with industrial and agricultural wastes) in developing countries is discharged into rivers, lakes or the sea without any treatment Untreated sewage spreads faeces, kills fish and other living things and spoils tourism.

High levels of nitrogen from faecal matter contribute to accelerated growth of water hyacinth, a weed that chokes waterways (blocks navigation, pumping stations and hydroelectric generators), and robs marine life of oxygen and other nutrients.

3. What can be done?

Faeces can not only be made safe but it and urine can be used as soil conditioners and fertilisers while saving precious water resources

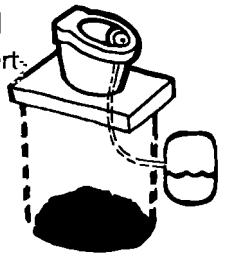
We must think and act differently to further develop and use ecological sanitation (ecosan) around the world.

4. What is ecological sanitation?

Any process which *protects human health, does not pollute; re-uses urine and/or faeces; and reduces water waste.* Current and emerging ecosan technologies can reduce costs to families and municipalities and are just as convenient as conventional toilets and latrines. Basic ideas for *ecological sanitation are:*

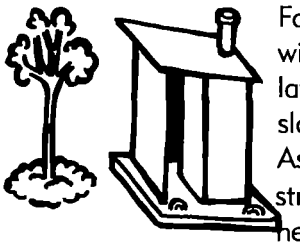
Don't mix faeces with urine or water.

Keep faeces separate from urine and water at the latrine or toilet using diverting seats or squatplates. Separation allows urine to be used immediately as a fertiliser and allows faeces to be contained until it has broken down and is safe to use.



The urine of 30 people can replace the N,P,K from a hectare of soil each year.

If you must mix faeces with urine, put it to its safest most direct use.



Faeces can be safely mixed with urine in very shallow pit latrines using portable seats, slabs and superstructures. As soon as the pit is full, the structures are moved onto a new pit The old pit is topped-up with mulch and planted with a fuel-wood or fruit tree. Such "arbor loos", "fossa alternas" or moving pits keep faeces and urine contained, do not require faeces to be handled at any time and provide systematic fertilisation for orchards or plantations.

Every adult can produce enough fertiliser every year to grow all his or her own food.

ANNEX III

Contain faeces: stop sharing it!

Always put faeces where babies, adults, animals, insects and the weather will not spread it

Improved sanitation can reduce diarrhoea deaths by 60%, episodes of diarrhoea by 36% and child stunting by up to 50%!

Stop whatever faeces have escaped from getting back into our bodies.

Wash hands, especially before putting them into the mouth or touching food. Use the "run to waste" method of hand washing and at best use soap to cleanse hands; otherwise use ash or sand and water, or water alone.

Keep clean every thing used to feed babies, prepare, serve or eat food or drink water. Cook food thoroughly and reheat it properly.

Washing hands reduces diarrhoea episodes by 33%. Food hygiene reduces diarrhoea episodes by 70%

Make contained faeces not only safe, but also useful and agreeable to use.

Let faeces dry up don't mix it with urine or water. Add dry kitchen waste (peels, leaves, leftovers) as well as garden trimmings and other dry organic matter to the faeces to help it break down faster. Add ashes or lime to dry it out. This starves and dehydrates germs and worms, stops bad smells, reduces flies and other vermin and keeps the separated urine sterile.

Stop wasting water and stop polluting.

Encourage ecological sanitation in rural and urban areas. Instead of "moving up" from pit latrines (often a source of ground water contamination) to costly sewer systems (which waste and contaminate water), convert existing systems to ecosan latrines and toilets Where people have no facilities, promote ecosan to save lives, resources, money and our environment.

STOP stockpiling it: USE faecal resources

Use safe, dry faeces to enhance soil to grow firewood, fruit trees, animal or human food. Like animal manure, human faeces help retain water in soil, allow good bacteria to grow, keep plants healthier and prevent erosion. Separated from urine and allowed to dry, faeces have no offensive smell, allowing sanitation facilities to be built close to or in homes.

Human urine contains the same NPK value as chemical fertiliser, and in addition has micro trace elements beneficial to crop growth.

Annual excretion of fertiliser by humans compared with fertiliser requirement of cereal

Fertiliser	500 litres urine	50 litres faeces	Total	Fertiliser need for 230kg cereal
nitrogen	5.6kg	0 09kg	5 7kg	5.6kg
phosphorus	0 4kg	0.19kg	0 6kg	0.7kg
potassium	1.0kg	0.17kg	1.2kg	1 2kg
Total N+P+K	*7.0kg (94%)*	*0.45kg (6%)*	*7.5kg*	*7.5kg*

(source M Wolgast 1993, Recycling system brochure by WM Ekologen ab, Stockholm, Sweden)

Use urine diluted with water as a clean, cheaper substitute or supplement to petrochemical fertilisers Most developing countries are economically distressed and factory produced fertilisers are unaffordable With ecological sanitation, farmers at subsistences, family and commercial level can produce their own or supplement animal and chemical fertilisers while solving local hygiene problems.

5. And finally ... dare to think different!

Think ecologically: "it's" not waste, "it's" a resource!

Excrement Happens *by Peter Montague*

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ANNEX III

For centuries, society has been faced with a problem; what to do with vast volumes of waste produced by its population
Treated properly, human excreta can be a natural and beneficial fertilizer
But today, across the industrialised world, we are paying the price for two centuries of a 'get rid of it' approach to human wastes - and our soil is poisoned as a result

How it All Began

Humans began to lead a settled life, growing crops to supplement hunting and gathering only about 10, 000 years ago. For all time before that, humans "deposited their excreta - urine and faeces - on the ground, here and there, in the manner of all other land creatures." The soil and its communities (including plants, small animals and micro-organisms) captured almost all of the nutrients in animal excrement and recycyled them into new components for soil. In this way, the nutrients were endlessly recycled within the soil ecosystem and largely kept out of surface water.

As a result, what we call "pure water" is low in nutrients, particularly the major nutrients nitrogen and phosphorus. Because these conditions have existed for a very long time, life in lakes, rivers and oceans is accustomed to the relative absence of these nutrients. Over the past couple of billion years, life has flourished in this low-nutrient environment, growing complex and interdependent in the process - an aquatic condition we call 'clean' and 'healthy'.

Whe a body of water is suddenly inundated with nutrients - especially nitrogen and phosphorus - things change drastically. One or a few organisms flourish and begin to crowd out the others. We can all recall seeing a body of water that is pea-soup green from overgrowth of algae. Such a water body is clearly sick, choked its diversity vastly diminished.
Today, much of the surface water of the planet is in a stage of ill health because of misplaced nutrients And a main contributing culprit is misplaced human excreta.

East and West: conflicting Views on Sewage Management

Long ago, human civilisations split into two camps regarding the management of excreta
Many Asian societies recognised the nutrient value of 'night soil' (as it became known)

For several thousand years, and up until very recently, Asian agriculture flourished by recycling human wastes into croplands. The opposing camp, particularly in Europe, had ambiguous feelings about human waste - was it valuable fertilizer or was it a nasty and embarrassing problem to get rid of? In Europe, a pattern evolved: the first stage was urinating on the ground near dwellings. As population density increased, this became intolerable and the community pit evolved. For privacy, this evolved into the pit privy or 'outhouse' - a structure for privacy atop a hole in the ground. Despite what many people think, the pit privy is not environmentally sound - it deprives the soil of the nutrients in excrement, and by concentrating wastes it promotes pollution of groundwater by those same nutrients.

Before the advent of piped water in the late 8th century, European towns stored excreta in cesspools (lined with some drainage of liquids) or in vault privies (tight tanks without any drainage). The 'night soil' was removed by 'scavengers' and was either taken to farms, or dumped into pits in the ground or into rivers. In general, Europeans never developed a clear and consistent perception of the nutrient value of excrement, as Asians had done.
In ancient Rome, the wealthy elite had indoor toilets and running water to remove excrement via sewers. Later, European cities developed crude sewer

systems - usually open gutters but sometimes covered trenches along the centre or sides of streets - though they had no running water until the 18th or 19th century. The putrefying matter in these stagnant ditches did not move until it rained - thus the name 'storm sewers' - and many cities prohibited the dumping of human wastes into them.

The Birth of the Modern Sewage System

But as with every new technology, the piping of water brought new and unforeseen problems of its own Water piped into homes had to be piped out again, and this caused cesspools to overflow, increasing the problems of odours and of water-borne diseases

With the advent of piped water, things changed dramatically. In the USA, the first waterworks was installed in Philadelphia in 1802, and by 1860 136 cities were enjoying piped water systems. By 1802, the number was up to 598. With piped water, per-capita water use increased at least 10-fold, from 3-5 gallons per person per day to 30-50 gallons per person per day or even more.

To solve these problems, cesspools were connected to the cities' crude sewer systems which ran along the streets. The result was epidemics of cholera. In Paris in 1982, 20, 000 died of cholera. Around the world, the combination of piped water and open sewers has consistently led to outbreaks of cholera. To solve this problem, engineers designed closed sewer systems, pipes using water as the vehicle for carrying away excrement. This solution engendered a debate among engineers: some wanted to return sewage to agricultural land, others argued that 'water purifies itself' and wanted to pipe sewage was being dumped into water bodies on a grand scale. This decision - taken for short-term reasons - was to prove damaging in the long run.

Industry changes the Rules

Because sewers already existed, and because the public was paying for them, they were the obvious places for dumping industrial waste As the pressure for greater waste dipsosal capacity increased, industrialised nations allocated vast sums of money to construct centralised sewer systems to serve the combined needs of homes and factories.

In the cities, the cholera epidemics abated. However, cities drawing their drinking water downstream from sewage discharges began having outbreaks of typhoid, caused by the emptying of sewage into clean water. This engendered another debate: whether to treat sewage before dumping it into water bodies used for drinking, or whether to filter drinking water. Public health officials favoured treating sewage before dumping it ; sanitary engineers favoured dumping sewage raw and filtering water before drinking. Again, the engineers prevailed, again largely for reasons of ease and covenience. And again, this created unforseen problems.

As cities began to filter and disinfect their drinking water, typhoid began to abate. But throughout the 20th century, as the West industrialised rapidly, industry developed a huge demand for low-cost waste disposal. But sewers had been designed for human wastes, not industrial chemicals, and as industries began to use them as giant drains for their poisonous wastes, new and virulent dangers emerged. The nutrients in the excrement became mixed with industrial chemicals, and as industries began to use them as giant drains for their poisonous wastes, new and virulent dangers emerged. The nutrients in the excrement became mixed with industrial wastes, many of the toxic.So by the 1950s, essentially every body of water receiving piped wastes was badly polluted with a combination of excessive nutrients and toxicants. This led to a new demand; to treat wastes before dumping them into water. Thus began the "treatment" phase of the "get rid of it" approach to human waste; the latest in adulterating of a clean, natural and even beneficial waste product by unnatural poisons.

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The Failure of Sewage Treatment

The first stage in the process of modern sewage treatment is 'primary treatment' - screening out the dead cats and other 'floatables' from the sewage. All other nutrients and toxic chemicals remain in the waste water that is discharged to a river or ocean. Next comes 'secondary treatment' which speeds up the biological decomposition of wastes by forcing oxygen into them, by promoting bacterial growth, and by other means. This is an energy-intensive process and therefore expensive. Unfortunately it, too, leaves many of the nutrients and toxic in the discharge water. This two-stage treatment process ends up by creating a new form of combined nutrients and toxins known as 'sludge'. Sludge is the de-watered, sticky black "cake" created in large quantities by modern sewage treatment plans. It contains everything that can go down the drains in homes and industries and which a treatment plant is able to get back out.

Industry is currently using 70,000 different chemicals in commercial quantities; any of these may appear in sludge. About 1,000 new chemicals come into commercial use each year, so any of these, too, may appear in sludge. A description of the toxicants that may be found in sludge would fill several books. The US General Acconting Office has reported - not surprisingly - that municipal sludge regularly contains radioactive wastes (from both medical and military sources).

With hundreds of sewage treatment plants now producing toxic sludge in mountainous quantities, the next question was, what in the world to do with it? For many years, coastal cities had dumped sewage into the oceans, where it created "dead zones" that could not support marine life. New York dumped its sewage sludge 12 miles offshore; when that place developed obvious contamination problems, the dumping was moved to a spot 106 miles offshore, where, to no one' s surprise, contamination soon developed. Other communities dumped their sludge into landfills, where it polluted their groundwater. Still others incinerated their sludge, creating serious air pollution problems, then landfilled the remaining ash or simply heaped it on the ground for the wind to disperse.

In 1998, the US Congress, in line with other government authorities across the industrialised wolrd, outlawed the ocean dumping of sewage sludge. At this point, many communities faced a real waste crisis. There was no safe (or even sensible) place to put the mountains of toxic sludge that are generated every day by centralised sewage treatment systems. It was at this point in history that US EPA-feeling tremendous pressure to 'solve' the sludge disposal problem - discovered that sewage sludge is really 'night soil' after all - the nutrient-rich product that has fertilized crops in Asia for several thousand years. The EPA, the latest in the long line of authorities tackling a serious problem in a short-sighted way, decided that the expedient thing to do with sewagesludge was to plough it into the land.

In the US Federal Register of November 9, 1990, the US Environmental Protection Agency (EPA) describes sludge this way: *"The chemical composition and biological constituents of the sludge depend upon the composition of wastewater entering the treatment facilities and the subsequent treatment processes. Typically these constituents may include volatiles, organic solids, nutrients, disease-causing pathogenic organisms (e g bacteria, viruses, etc) heavy metals and inorganic chemicals from industrial wastes, household chemicals, and pesticides "*

Shortly after 1992, when the ban on ocean dumping went into effect, the EPA renamed toxic slude 'beneficial biosolids', and began aggressively campaigning to sellit to the American people as fertilizer.

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The increasingly complicated methods of dealing with human wastes combined had thus, in the USA, come full circle The fertiliser value of human wastes had been officially recognised. What had been officially unmentioned was that the 'night soil' being spread on the fields typically contained thousands of industrial poisons The EPA overlooked, perhaps deliberately, two important differences between modern sewage sludge and unadulterater human waste

The challenge before us is clear· we must find ways, such as those above, to deal with human wastes in a way that allows their potential to be realised At the same time, we must keep those wastes apart from the industrial poisons they are currently mixed with It is time that industries realised that dumping their toxic by-products into the nearest sewer will never be a sustainable way of dealing with them.

The Official Poisoning of the Soil

Firstly, most of the nitrogen in human waste is in the urine and is water-soluble, so it is not captured in the sludge. Therefore, if sludge is going to substitute for commercial fertilizer, you have to use a lot to get enough nitrogen. And, secondly, when you add a lot of sludge to soil, you are also adding a lot of toxic metals and a rich (though very poorly understood) mixture of organic chemicals and, very likely, radioactive wastes as well. In sum, ploughing sewage sludge into soils is almost guaranteed to harm any of those soils as time passes. And as we know from the ancients who poisoned their soils with irrigation salts, a nation that poisons its farmland is a nation that doesn't have a long- term future.

Rethinking the Sewage Problem

It is time that we in the West began to think again about how we would deal with human waste. The present systems were not designed to produce useable products and therefore the design of present systems is the root of the problem. I would suggest that three policy goals are needed Firstly, wherepossible, the individual should practise 'sewer avoidance' - stay off or get off centralised sewer systems. Secondly, governments should promote low-cost, on-site resource-recycling technoligies, such as composting toilets, that avoid polluting water and preclude wasting resources. Thirdly, water should be priced right - i.e. higher than at present - so that the market works to keep it clean, rather than contaminate it with excreta.

None of this is as difficult as it might sound. for individual households, for example, real solutions are already available. An excellent new book by David del Porto and Carol Steinfield, ***The Composting Toilet System***, will dispel any fears you may have that composting toilets are a step backward. And with microflush toilets and vacuum-flush toilets now readily available, you can compost your household wastes into an odour-free product that is entirely satisfactory as agricultural fertilizer. And for larger buildings, the technology already exists for manufacturing building-scale waste systems based on 'anaerobic digesters', which produce methane gas and fertilizer. As human waste expert Abby Rockefeller said recently in an interview, "Surely, human ingenuity can do this". Toxic industrial wastes should be managed by the industries that make them, not dumped into the environment that sustains all life.

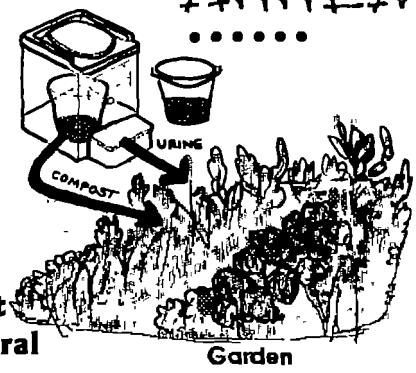
You may say that none of this is 'realistic' - that we can't do any of it because we've been doing it another way for 100 years. But ask yourself what king of people would dump their excreta into their drinking water in the first place. And what kind of people, faced with workable, cheaper, more environmentally sound alternatives would continue to insist that soiling their food, water and environment is still the best way of dealing with a problem that water environment is still the best way of dealing with a problem that many of us prefer not to think about, in the hope that it will go away.

This article is based in large part on the excellent work of Abby Rockerfeller, President of the ReSource institute for Low Entropy Systems, 179 Bolyston St, Boston, MA USA 02130; telephone (617) 524-7258 Un-referenced facts and sources are from her original work.

ECOSAN Ecological Sanitation SUDEA

ANNEX III

by Ms Almaz Terrefe & Mr. Gunder Edstrom



By ecological sanitation we in SUDEA mean a non-mixing toilet system which enables the recycling of human waste. In the process some wastewater and the organic household waste are also composted and turned into something useful and valuable. The process of recycling human-and household waste does not pollute the environment or misuse any other natural resource. While introducing the ECOSAN system, community participation, cultural sensitivity, cost benefit effectiveness and behavioural changes are essential.

This paper describes the experience of an integrated environmental sanitation and urban agriculture-based pilot programme under introduction in Ethiopia. The programme attempts to address two interdependent problems: the disposal of human- and organic household waste, and overcoming malnutrition through sustainable, small-scale urban agriculture in the cities and extended household agriculture in the rural areas where vegetables are produced close to the house. Participation enables the whole family to learn, produce and use home-grown vegetables.

The ECOSAN concept

The programme is based on the ECOSAN concept (economy, ecology and sanitation) — a system that integrates sanitation and agriculture, by using human wastes as fertiliser and soil conditioner. Urine is used diluted with water or undiluted. The faeces are stored and composted before use. In this way we believe, ECOSAN promises a clear advantage over the traditional water borne sanitation systems and other dry sanitation systems. While this system appears sound, its actual feasibility has yet to be empirically verified. It was with this in mind that the Society for Urban Development in East Africa embarked upon the pilot programme in Ethiopia.

We have so far constructed, and now manage some 100 units. A number of constraints and favourable conditions have been identified. The initial phase of introducing this innovation was smoothed thanks to its enthusiastic acceptance by the beneficiaries. At the next phase, that of maintaining the introduced units, two types of problems of different order were encountered: technical and behavioural problems. On the other hand, the increased yield of vegetables due to the intervention has contributed towards its continuation.

Urban agriculture or household gardening

Bio-intensive gardening or urban farming has become a steadily growing industry in many parts of the world. In recent years it has become a means of livelihood for hundreds and thousands, while millions more supplement their meals with fresh,
nutritive food. A piece of land of 15m can produce most vegetables needed for a small family (3-5 persons) and 40m allows an income generating activity. Bio-intensive gardening is also water-saving but labour intensive.

The ECOSAN toilet is a urine separating or non-mixing system that enables the separate storage of urine and faeces The urine is led through a pipe from a urine collector into a special container. The faeces, also collected in a separate container, are then mixed with ashes, soil, leaves, grass, sawdust or any other suitable material available. By not mixing the urine - "the natural fertiliser" - with the faeces, which contain most of the pathogens, the bad smell from the latrines is very much reduced. It also means that the treatment of the two ingredients can be done in a proper way - urine supplied to the fields as fertiliser, and faeces kept under control to minimise the effects of pathogens and intestinal parasites, and later used in the fields as soil conditioner.

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The ECOSAN toilet is an important partner for household gardening since it produces a clean, natural fertiliser and soil conditioner. Household gardening is important for the ECOSAN project since it makes use of the products from the ECOSAN toilets and the organic household waste and some wastewater

Part of a growing wall with lettuce, tomatoes, onion, grenadilla (passionfruit) and edible flowers.

For several reasons urban agriculture responds positively to initiatives which are on the global agenda including the fight against pollution, malnutrition, hunger, poverty, and unemployment. Out of about 100 simple, inexpensive, environmentally sound and culturally sensitive techniques, SUDEA is implementing four· FAITH gardening, double digging, container gardening and growing walls, even in areas where land is scarce. When available combined with drip irrigation.

Selecting the families

SUDEA is co-operating with national NGOs. The beneficiaries are selected by the local NGO and the local authority (Kebele) according to certain criteria: new sanitation is needed for the family, willingness to try this new system, not more than 10 persons in the family, and a piece of land for the household gardening. Willingness to assist in the building process and to learn about household agriculture is also a factor in selection.

Technical problems

Some technical problems have occurred Since the materials available on the Ethiopian market often are of low quality, especially plastic items like toilet seats and plastic pipes produced locally, this is reflected on the quality of the toilets built.

Social constraints

As far as we understand, sanitation awareness campaigns have always been of low priority in Ethiopia. Thus it is rather difficult to convince people to keep the toilet as clean as any other room in the home. As the system of ECOSAN demands relative cleanness, due to the use of the sitting position, and carefulness, to avoid mixing the urine with faeces, implementation demands a continued follow up. In many places this process has created a close relationship between SUDEA and the beneficiaries, while in some cases a very sensitive discussion takes place, when it is necessary to tell grownups: "Please clean your own toilet!" In many cases the difficulty of keeping the toilet clean is due to lack of water and soap. What we have learned so far is the importance of clean water and raising countrywide awareness on environmental sanitation.

Advantages

Tests made on the fertilising effect of the urine indicate an increased yield of 50 - 200% the "normal" yield In a home garden of 15 m the production of vegetables is estimated to provide an average Ethiopian family with about 75% of the vegetables and fruits needed. At the same time the system can also make use of the organic waste produced in the home and recycle it into edible products. This type of dry sanitation needs very little water, only for cleaning the toilet once a day. The water needed for irrigation is about 25 litres and compared to a WC, which consumes at least 100 litres a day in an average Ethiopian family, the saving is considerable. The ECOSAN agriculture system can also make use of some of the wastewater from washing and cleaning.

Participants & Facilitators

ANNEX IV

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Acronyms Used in this Report

CBO	Community Based Organisation
CREPA	Centre Regional pour l'Eau Potable et l'Assainissement a faible cout (Centre for Drinking Water & Affordable Sanitation)
CSIR	Cetre for Scientific & Industrial Research (now renamed Division of Building Technology), South Africa
CWS	Centre for Water & Sanitation
DANIDA	Danish International Development Agency
DfID	Department for International Development
EcoEd	Ecological Education (EcoEd Trust, Zimbabwe)
ecosan	ecological sanitation
ECOSAN	Economic, Ecological Sanitation
EHD	Environmental Health Division
ESA	External Support Agency
HIV/AIDS	Human Immune-Deficiency Virus/ Acquired Immune Deficiency Syndrome
Homex	Homo Sapiens EXcreta / Home EX (things out-of the home)
ITN	International Training Network
IWSD	Institute for Water & Sanitation Development
KAP	Knowledge, Attitude & Practices (study)
M&E	Monitoring and Evaluation
MLG&NH	Ministry of Local Government & National Housing
MoH&CW	Ministry of Health & Child Welfare
NAC	National Action Council
NETWAS	Network for Water & Sanitation International
NGA	Non-Governmental Actor (private sector)
NGO	Non-Governmental Organisation
N,P,K	Nitrogen, Phosphorus, Potassium (fertilser)
NWC	National Water Corporation
OAU	Organisation for African Unity
O&M	Operation & Maintenance
PAH&S	Participatory Approaches in Hygiene & Sanitation
PHAST	Participatory Hygiene and Sanitation Transformation
PRA	Participatory Rural Appraisal
R&D	Research & Development
RELMA	Regional Land Management Unit
RUWASA	Rural Water and Sanitation Project, Government of Uganda
RWSG-ESA	Regional Water & Sanitation Group for East and Southern Africa (UNDP/World Bank)
SADC	Southern Africa Development Community
SCF	Save the Children Fund
Sida	Swedish International Development Agency
SUDEA	Society for Urban Development in East Africa
TREND	Training Research & Networking for Development Group
UNAIDS	United Nations Programme on AIDS
UNDP/WB	United Nations Development Programme/World Bank
UNICEF	United Nations Children's Fund
UNSIA	United Nations Special Initiative on Africa
VIP	Ventilated Improved Pit (latrine)
WES	Water and Environmental Sanitation
WSP-ESA	Water & Sanitation Program, East & Southern Africa
WHO/AFRO	World Health Organisation / Africa Regional Office

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Ecological Sanitation

Ecological sanitation is an emerging option with great promise for solving Africa's sanitation problems. It has logical linkages to agriculture, forestry, income generation, waste management, the environment and many other sectors beyond the "traditional" health and hygiene aspects used to "sell" sanitation.

Combined with social and cultural sensitivity to user needs, with participatory approaches for communities to identify problems, analyse them and take action, and supported by local and regional networks to strengthen information exchange and resource mobilisation, ecological sanitation may very well revolutionise this field.